A BREEFE TREATISE OF SPHÆRICALL TRIANGLES,

Wherein is handled the sixteene Cases of a right angled Triangle, being all extracted out of one Diagram, and reduced into Theorems, with the totall sine in the first place, so that by addition onely, they may be effected.

As also,

The twelue Cases of an oblique Sphæricall Triangle, being likewise reduced into Theorems, whereby with one or two additions at the most, any of them may be resolued by helpe of this Canon following made with secants, and that only by such numbers as are therein to be founde, without first making any substraction, or vsing any mentall operation.

Most commodious and necessarie in both kindes of Triangles: viz. right lined and Sphæricall, in the solution of Propositions of both the Globes, in Dialling, Fortification, *and* Nauigation, *with highte and distances: all which may hereby be performed by addition only. The like not hetherto set forth by any.*

By IOHN SPEIDELL Professor and teacher of the Mathematickes in Queene-streete.

Whereunto is annexed a Geometricall Extraction formerly published by this Author, containing diuers delightfull and necessarie Geometricall Problemes for all Suruaighers and others, affected to the Mathematickes.

LONDON,
Printed by EDWARD ALLDE dwelling neere Christ-Church. 1627.

A
BREEFE TREATISE OF
SPHERICALL TRIANGLES.

Wherein [illegible] the [illegible] right angled [illegible], being [illegible] one Degree, and reduced into Theoremes, with the [illegible] in the first place, to [illegible] they may be effected.

The twelue Cases of an obliquangled Triangle, being likewise reduced into Theoremes, whereby with one or two additions at the most, any of them may be resolued by helpe of this [illegible], and that only by such numbers as are [illegible], without making any [illegible], or [illegible].

Most commodious and necessarie in both kindes of Triangles: viz. regular and irregular [illegible] the Globe, in Degrees, [illegible] and [illegible] by minutes only. The [illegible]

By [illegible] Professor and teacher of the Mathematicks in [illegible]

Whereunto is annexed a [illegible] many [illegible] and [illegible]

LONDON,
[illegible]

¶ To the Right HONOVRABLE, S^r. IOSSELINE *Percy*, KNIGHT.

SIR,

HAuing for these eighteene yeares, had experience of your Noble affections towards all good learning, but especially to the Mathematickes, wherein, at times, it hath pleased you to receaue some instructions from me; and for that your industry hath made tryall of all sortes of Logarithmes, that now are extant, I haue beene bould to present to your Honourable view this small Treatise, as vnto one that is able to iudge and discerne betweene it and others; which doth most readily, and with lesse lines or numbers, effect the same truth: Desiring that in your accustomed fauour & loue of Arte, you will be pleased to accept hereof, with so good a will as I haue written the same, for the aduancement of your skill, and others well affected to the Mathematickes: and so with all my studies and endeauours I remaine, alwaies at

Your Honourable disposition:

IOHN SPEIDELL.

To the Reader.

Courteous Reader,

HAuing some ten yeares past, set forth a Geometricall Extraction containing of the chiefe and choisest Problemes; and finding the same to haue beene well accepted amongst diuers learned in the Mathematickes, it hath giuen me occasion to proceede further, and to set forth this Canon for Sphæricall Triangles, made with Sines, Tangents and Secants, which first in anno 1619. I caused to be printed without any vses thereof, wherein is of purpose left out the totall sine in all the secants, and in euery tangent aboue 45. degrees to a good end: for that thereby they are made able by addition only, to resolue any kinde of Sphæricall Triangle, right or oblique: which Canon I extracted from and out of the Logarithmes set forth by the first Inuentor thereof (My Lord of Marchiston of famous memory) They being first by mee ouerseene, corrected and amended, wherein I spent halfe a yeare before I could bring this Canon into the forme here present, which for all vses is the best, as thou shalt quickely perceiue, if thou wilt be pleased to make tryall of others with this: And for that I finde this daily to be so well accepted of all those that haue first wrought by others, that they are well contented to leaue all them, & to make vse of these alone: It hath againe giuen me a second occasion to proceede one degree further & to write some vses thereof, which here thou hast in the solution of the 16. Cases of a right angled, as also in the 12. Cases of an oblique angled Sphæricall Triangle: being all performed by addition, only by such numbers as are to be founde in my Canon, & there is no need to make any substraction from or out of the totall sine to get those numbers which will serue to

effect the same by addition only, as in vsing others they must do, whereby time is spent, and error endangered: And if I shall perceiue this to be well respected, it shall giue me occasion to goe foreward, and to write perticular vses thereof in the Propositions of both the Globes, and for Nauigation, with the vse of another Logarithme by me set forth 4. yeares agoe, of great vse in Geometrie and Arithmeticke, whereof I haue giuen a touche in the end of this Treatise.

Thus desiring thee to esteeme this forme of Logarithmes made with secants (and that in them leauing out the totall sine, as also in all tangents aboue 45. *degrees) the best forme for all vses, vntill thou shalt see a better produced: And so I rest thine with all my studies and endeauours,*

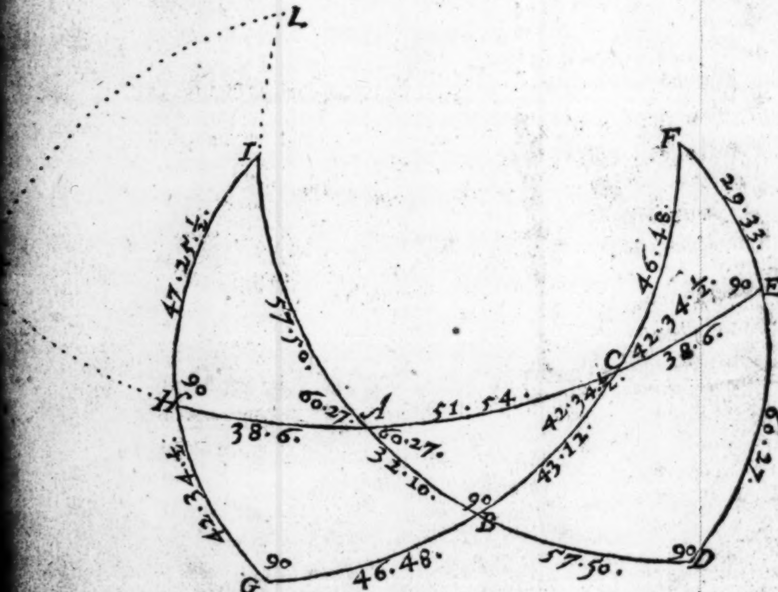
I. S.

The Author to the friendly Reader.

IF that hereby thou doest get skill,
Reward me not with speaking ill:
But rather if thou learne apace
Speake well of me in time and place,
So shall I thinke my paines well taine,
And study for to write againe
Another, that shall surpasse this,
And mend some things that are amis,
Whereby thou shalt much fruit obtaine,
And wish that I, would write againe.

To the M. C. Z.

IF that thou canst amend it,
So shall the Arte increase:
If thou canst not: commend it,
Else, pree-thee hould thy peace.


L
I
F
47.25½.
57.50.
46.48.
29.33.
E
90
42.34½.
C
42.34½.
38.6.
H
90
60.27.
A
51.54.
38.6.
60.27.
32.10.
43.12.
60.27.
42.34½.
90
B
90
D
90
G
46.48.
57.50.

A BREEFE TREATISE OF SPHÆRICALL TRIANGLES

written by IHON SPEIDELL, Professor of the Mathematicks in *London*.

IN Sphæricall triangles, there are 28. Cases, *viz.* 16. of a right-angled Triangle, and 12. of an oblique, all which shall be handled as followeth.

And first of the 16. Cases of a right angled Sphæricall Triangle.

For as much as they depende vpon 3. Axiomes of *Petiscus*, (as also vpon a fourth) whereby those Theorems, which out of the figure following being extracted, haue not the totall sine in the first place, may be reduced to haue the same, so that by addition only they may be performed: I will therefore only repeate them, referring the Reader for the demonstration of the 3. first, to his Booke in English from page 112. to 121. and for the fourth to page 91.

The first Axiome.

In many right angled Sphæricall Triangles hauing one and the same acute angle at the base, the sines of their Hipothenusæs and of their perpendiculars are all of them proportionall one to the other, as in the Triangles A B C. and A D E. of the figure following hauing one common angle A. at the base; it is as the sines of,

AC ——— AE ——— CB ——— ED.

or as

AC ——— CB ——— AE ——— ED.

The second Axiome.

In many right angled Sphæricall Triangles hauing one and the same acute angle at the base, the sines of their bases, and the Tangents of their perpẽdiculars, are all proportionall one to the other.

As in the same Triangles A B C. and A D E. hauing the same common angle A. at the base, it is as,

Si. AB ——— *Si.* AD ——— *T.* BC. ——— *T.* DE.

Or as,

Si. AB ——— *T.* BC ——— *Si.* AD. ——— *T.* DE.

The third Axiome.

In all Sphæricall Triangles, the sines of their sides are directly proportionall to the sines of their opposite angles.

As in the same Triangle ABC. it is as the sines of,

B ——— CA ——— A ——— BC.

or as

AC ——— B ——— BC ——— A.

The fourth Axiome.

Is the first of the third booke of *Petiscus* page 91. whereby it is manifest, that,

The sine of any arche being Radius, the totall sine is secant complement of that arche. Also,

The tangent of any arche being Radius, the totall sine is tangent complement thereof.

These being rightly vnderstood, the 16. Cases may all be extracted from the figure following: which figure is also found in *Petiscus*, but not by him applyed to all the 16. Cases, saue onely to that where the 3. angles are giuen, to finde the subtendant side, but making the middle Triangle the Triangle giuen, it may be applyed (as I doe here) to them all, and so auoide the trouble of drawing all the other figures.

In which Triangle ABC. euery side thereof being both wayes extended to full quadrants, making the angles E. D. B. G. H. right angles, & the arches ED. FB. | CG. CH. | AD. AE. | & IG. IB. | quadrants of 90. degrees a peece, the other angles at I. A. C. and F. are oblique: & for that by the 58. of the first booke of *Petiscus*

page 23. the sides of the Triangle ABC. being continued out till they are quadrants, the arch BD. shall be the measure of the angle F. ED. of A. HG. of C. and BG. of I. this being well conceaued for euery of the 16. Cases, there may be extracted a perticular Theorem, *viz.*

The first Case.

The subtendant side and one oblique angle being giuen, to finde the side opposite to that angle.

Data $\left\{\begin{matrix} AC. \\ A\ . \end{matrix}\right\}$ *demand.* BC.

By the first Axiome it is as the sines of,

AE.——— ED.——— AC. ——— CB.

In the figure following consider what AE. is, and you finde 90. degrees, that is the totall sine, also what ED. is, and you finde the measure of the angle A. likewise what AC. is. And you find the subtendant side, lastly what CB. is, namely the side req. whence the Theoreme is thus collected.

As the totall sine to the sine of the angle giuen, so the sine of the subtendant side, to the sine of the side required.

Which is lesse then a quadrant if the giuen angle be acut, but more being obtuse.

	d. m.		d. m.
90.——	60. 27.	———	51. 54.
	986065.		
	976039.		
			d. m,
Fa.	962104.	a sine of	43. 12. for BC. the side required.

I omit here to write how by the Theorem to set it in the rule, for I suppose euery one that will buy this Treatise, hath so much skill, else he will not desire it.

The vnskilfull may thinke this is not rightly added, because it should be 1962104. but I leaue out the 7. place from the right hand being the totall sine, for that according to the course of the rule, it is to be substracted from the some of the other 2. being added. And being taken away, the number shall be but 962104. as now you see, the like in others, &c.

The subtendant side, and one obliq. angle being giuen, to finde the other obliq. angle.

Data. { A C. A. } Demaund C.

For as much as in the figure following the 2. Triangles A D E. and A H I. hauing one and the same angle A. at the base, the angles D. and H. being right angles, so that if the Triangle A H I. were laide vpon the Triangle A D E. viz. A H. on A D. and A I. on A E. their angles at A. being equall, they would agree together, and fall within the compasse of the second Axiome, by which it is as *si.* A D. —— *T.* D E. —— *si.* A H. —— *T.* I H.

Then considering as before what A D. D E. A H. and I H. in the figure following are, the Theorem may be thus collected.

As the totall sine, to the tangent of the giuen angle, so the sine complement of the subtendant side, to the tangent complement of the angle required.

Which if the subtendant side be lesse then a quadrant and the giuen angle acut, or being more and the angle obtuse, is lesse then a right angle or 90. degrees: but if the subtendant side be lesse then a quadrant, and the angle giuen obtuse, or being more and the angle acut, the angle found shall be obtuse, that is more then a quadrant or 90. degrees.

	d. m.		d. m.
90. ——	*T.* 60. 27. ——		*co.* 51. 54.
			951717.
			56753.
	d. m.	*sa.*	8470.

A *T.* complement of 42. 34 ½. for the angle C. required.

The third Case.

The subtendant side and one obliq. angle being giuen, to find the containing side adioyning that angle.

Data { A C. A. } Demaund A B.

By the second Axiome it is as,

si. F E. —— *T.* E C. —— *si.* F D. —— *T.* D B.

Then considering what the letters signifie in the figure, the

Theorem

Theorem is thus collected.

As the sine complement of the giuen angle, to the tangent complement of the subtendant side, so the totall sine, to the tangent complement of the containing side required.

Or by the 4. Axiome.

As the totall sine, to the tangent complement of the subtendant side, so the secant of the giuen angle, to the tangent complement of the containing side required.

Which is lesse then a quadrant (if the subtendant side be lesse then 90. degrees, and the angle giuen acut) or being more and the angle obtuse: but if the subtendant side be lesse then 90. degrees, and the giuen angle obtuse, or more and the angle acut, the side found shall be more then a quadrant.

d. m. d. m.

90. —— *T.co.* 51. 54. —— *se.* 60. 27.

975678.

70687.

m. *fa* 40303. a tangent complement of 32. d. 10. for the side A B. required.

The fourth Case.

The subtendant and one containing side being giuen, to finde the angle betweene them.

Data { A C. A B. } *Demaund.* A.

By the second Axiome it is as,

T. BD. —— *si.* D F. —— *T.* C E. —— *si.* F E.

Then considering the letters in the figure, the Theorem may be thus collected.

As the tangent complement of the containing side giuen, to the totall sine, so the tangent complement of the subtendant side, to the sine complement of the angle required.

Or by the 4. Axiome.

As the totall sine to the tangent of the containing side, so the tangent complement of the subtendant side, to the sine complement of the angle.

Which is acut, if both the subtendant and the containing sides gi-

uen are more or lesse then 90. degrees, but if one of them be more and the other lesse, then it shall be obtuse.

	d. m.		d, m.
90. ——	T. 32. 10. ——	T. Co.	51. 54.
			975678.
			953625.
	d. m.	sa.	929303.

A sine complement of 60. 27. for the angle A. required.

The fift Case.

The subtendant and one containing side being giuen, to finde the angle opposite to that containing side,

Data. { AC. AB. } *Demaund* C.

By the first Axiome it is as the sines of,

CA. —— AB. —— CH. —— HG.

Then considering the letters in the figure, the Theorem is thus collected.

As the sine of the subtendant side, to the sine of the containing side giuen, so the totall sine, to the sine of the angle required.

Or by the fourth Axiome.

As the totall sine, to the sine of the containing side, so the secant complement of the subtendant side, to the sine of the angle.

which is acut, if the containing side giuen be lesse then a quadrant and obtuse, if more,

	d. m.		d. m.
90. ——	32. 10. ——	se. co.	51. 54.
	936961.		
	23961.		
			d. m.
Fa.	960922. a sine of		42. 34. $\frac{1}{2}$.

for the angle C. required.

The sixt Case.

The subtendant and one containing side being giuen, to finde the other containing side:

Data { AC. AB. } *Demaund.* BC.

By the 3. Axiome it is as the sines of,

IA. —— H. —— AH. —— I. or GB.

Then considering the letters in the figure, the Theorem is thus extracted.

As the sine complement of the containing side giuen, to the totall sine, so the sine complement of the subtendant side, to the sine complement of the side required.

Or by the 4. Axiome.

As the totall sine, to the secant of the containing side giuen, so the sine complement of the subtendant side, to the sine complement of the containing side required.

Which shall be lesse then a quadrant, (if both the subtendant and containing sides be more or lesse then 90. degrees) but if the one be more and the other lesse, the side found shall be more then a quadrant.

		d. m.		d. m.
90. ——	*Se.*	32. 10. ——	*Co.*	51. 54.
				951717.
				16664.
		d. m.	*Fa.*	968381.

a sine complement of 43. 12. for BC. required.

The seauenth Case.

One containing side with the angle adioyning being giuen, to finde the angle opposite to that containiug side,

Data. { AB. A. } *Demaund.* C.

By the 3. Axiome it is as the sines of,

H. —— IA. —— A. —— IH.

Considering the letters in the figure, the Theorem is thus extracted.

As the totall sine, to the sine complement of the containing side, so the sine of the angle giuen, to the sine complement of the angle required.

Which shall be acut, if the giueu side be lesse then 90. degrees but obtuse if more.

90.

d. m. d. m.

90. —— co. 32. 10. —— —— 60. 27.

986065.
983336.

d. m. sa. 969401. a sine complement of 42. 34. ½. for the angle C. required.

The eight Case.

One containing side with the angle adioyning being giuen, to finde the other containing side.

Data { A B. A. } *Demaund.* B C.

By the second Axiome it is as,

Si. A D. —— *T.* D E. —— *Si.* A B. —— *T.* B C.

Considering the letters what they represent in the figure the Theorem is.

As the totall sine, to the tangent of the angle giuen, so the sine of the containing side, to the tangent of the side required.

Which is lesse then a quadrant if the giuen angle be acut, or more being obtuse.

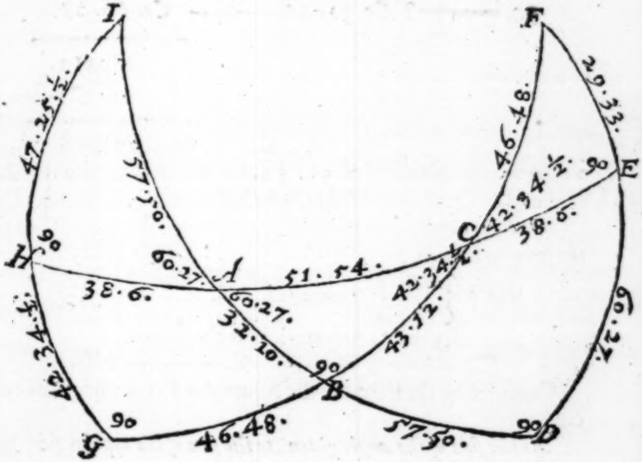
d. m. d. m.

90. —— T. 60. 27. —— —— 32. 10.

936961.
56753.

d. m. Ta. 993714. a tangent of 43. 12. for the side A B. required.

Now followeth the Figure.



The ninth Caſe.

One containing ſide with the angle adioyning being giuen ; to find the ſubtendant ſide.

Data { A B. A. } *Demaund.* A C.

By the ſecond Axiome it is as,

Si. F D. —— *T.* D B. —— *Si.* F E. —— *T.* E C.

Conſidering what the letters repreſent in the figure, the Theorem is thus collected.

As the totall ſine, to the tangent complement of the giuen ſide, ſo the ſine complement of the giuen angle, to the tangent complement of the ſubtendant ſide.

Which is leſſe then a quadrant (if the giuen ſide be leſſe then 90. and the angle thereunto adioyning acut,) or if the giuen ſide be more then 90. and the angle obtuſe.

But if the giuen ſide be more then a quadrant, and the angle adioyning acut, or leſſe and the angle obtuſe, then the ſide found ſhall be more then a quadrant or 90. degrees.

	d. m.	d. m.
90.	*T. Co.* 32. 10.	*Co.* 60. 27.

929313.
46375.

Fa 975688. a tangent complement of 51. 54. for the subtendant side A C. required.

The tenth Case.

One containing side with his opposite angle being giuen, to finde the subtendant side.

Data { A B. C. } *Demaund.* AC.

By the 3. Axiome it is as the sines of,

C. —— A B. —— B. —— A C.

Considering the letters in the figure the Theorem is thus collected.

As the sine of the angle giuen, to the sine of his opposite side, so the totall sine, to the sine of the subtendant side.

Or by the 4. axiome.

As the totall sine to the sine of the side giuen, so the secant complement of the giuen angle, to the sine of the subtendant side.

Which is lesse then a quadrant (if both the angles be acut or obtuse, or if both the containing sides be lesse or more then 90. degrees) But if one of the oblique angles be acut & the other obtuse, or one containing side lesse and the other more then 90.) then the subtendant side shall be aboue a quadrant.

	d. m.	d. m.
90.	32. 10.	*Se. Co.* 42 34. ½

936961.
39074.

Fa. 976035. a sine of 51. 54. for the subtendant side A C. required.

The eleuenth Case.

One containing side with his opposite angle being giuen, to finde the other oblique angle.

Data

Data. { AB. C. } *Demaund.* A.

By the third axiome it is as the sines of,

IA. —— H. —— IH. —— A.

Then considering the letters in the figure, the Theorem is thus collected.

As the sine complement of the containing side giuen, to the totall sine, so the sine complement of the giuen angle, to the sine of the angle required.

Or by the 4. axiome.

As the totall sine to the secant of the containing side giuen, so the sine complement of the giuen angle, to the sine of the angle required.

Which shall be acut if the vnknowne side be lesse then a quadrant, or obtuse if more: also if the subtendant side be lesse then 90. degrees, and the angle giuen acut, or more, and the angle obtuse, the angle found shall be lesse then a quadrant.

But if the subtendant side be lesse then 90. deg. and the giuen angle obtuse, or more and the angle acut, the angle found shall be obtuse.

		d.	m.		d.	m.
90. ——	*Se.*	32.	10. ——	*Co.*	42.	34. ½.
					969400.	
					16664.	
d.	m.			*Fa.*	986064.	

a sine of 60. 27. for the angle A. required.

The twelfth Case.

One containing side with his opposite angle being giuen, to finde the other containing side.

Data. { AB. C. } *Demaund,* BC.

By the second Axiome it is as,

T. HG. —— *Si.* GC. —— *T.* AB. —— *Si.* BC.

Considering the letters in the figure, the Theorem is thus collected.

As the tangent of the giuen angle, to the totall sine, so the tangent of the containing side giuen, to the sine of the containing side required.

Or by the fourth Axiome.

As the totall sine, to the tangent complement of the giuen angle, so the tangent of the containing side giuen, to the sine of the side required.

Which is lesse then a quadrant (if the angle adjoyning the side giuen be acut, but more if obtuse, or if both the subtendant and containing sides giuen, be lesse then 90. degrees:) But if the subtendant side be lesse then a quadrant, and the containing side greater, the side found shall be more then 90. degrees.

Lastly, if both the subtendant and the containing sides be more then quadrants, the side found shall be lesse then 90. degrees: but aboue, if the subtendant side bee more and the side giuen lesse.

		d. m.		d. m.
90.	—	T. Co. 42. 34½	—	T. 32. 10.
				953625.
				8475.
		d. m.		Fa. 962100.

A Sine of 43. 12. for the side B C. required.

The thirteene Case.

The 2. containing sides being giuen, to finde the subtendant side.

Data. { A B. B C. } *Demaund* A C.

By the first Axiome it is as the sines of,

F B. —— B D. —— C F. —— C E.

Considering the letters, the Theorem is,

As the totall sine, to the sine complement of one of the containing sides, so the sine complement of the other containing side, to the sine complement of the subtendant side.

Which shall be lesse then 90. deg. (if both the giuen sides be more or lesse then quadrants) but if one side be lesse, and the other more, the subtendant side shall be aboue 90. degrees.

		d. m.		d. m.
90.	—	Co. 32. 10.	—	Co. 43. 12.

983336.
968388.

d. m.

Fa. 951724. a sine complement of 51. 54. for A C. the sudtendant side required.

The fourteenth Case.

The 2. containing sides being giuen, to finde one of the opposite angles.

Data { A B. / B C. } *Demaund.* A.

By the 2. Axiome it is as,

Si. A B. — *T* BC. — *Si.* A D. — *T.* DE.

Considering the letters in the figure, the Theorem is thus extracted.

As the sine of the containing side adioyning the angle required, to the tangent of the other, so the totall sine to the tangent of the angle desired.

Or by the 4. Axiome.

As the totall sine to the tangent of the side opposite to the angle desired, so the secant complement of the side adioyning the angle required, to the tangent of that angle.

Which shall be acut, (if the giuen side opposite to the angle sought for be lesse then a quadrant) but if more, the angle found shall be obtuse.

		d. m.		d. m.
90.	—	T. 43. 12.	—	Se. Co. 32. 10.

993712.
63039.

d. m.

Fa. 56751. a tangent of 60. 27. for the angle A. required.

The fifteene Case.

The 2. oblique angles being giuen, to finde the subtendant side.

Data. { A. C. } *Demaund.* A C.

For as much as in the former figure the Triangles A H I. and A D E. haue one common angle at A. and the angles H. and D. right angles, being laid one vpon the other, *viz.* A H I. on A D E. they will agree together and so fall within compasse of the second Axiome, wherefore it is as,

T. D E. — *Si.* A D. — *T.* I H. — *Si.* H A.

Considering the representation of the letters in the figure, the Theorem is thus collected.

As the tangent of one of the oblique angles to the totall sine, so the tangent complement of the other oblique angle, to the sine complement of the subtendant side.

Or by the 4. Axiome.

As the totall sine, to the tangent complement of one of the oblique angles, so the tangent complement of the other, to the sine complement of the subtendant side required.

Which shall be lesse then 90. degrees (if both the oblique angles be acut) but if one be acut and the other obtuse, it shall be more then a quadrant or 90. degrees.

		d. m.		d. m.
90	— *T.Co.*	60. 27.	— *T. Co.*	42. 34 $\frac{1}{2}$.
				943247.
				8475.
		d. m.	*Fa.*	951722.

A sine complement of 51. 54. for the subtendant side A C. required.

The sixteene Case.

The 2. oblique angles being giuen, to finde any of the containing sides.

Data. { A. C. } *demaund.* B C.

By the 3. Axiome it is as the sines of,

C. — F E. — E. — C F.

Considering the letters, the Theorem is,

As the sine of the angle adioyning the side required, to the sine complement

complement of the other angle, so the totall sine, to the sine complement of the containing side required.

Or by the 4. Axiome.

As the totall sine, to the sine complement of the angle opposite to the side required, so the secant complement of the angle adioyning that side, to the sine complement thereof.

Which shall be lesse then a quadrant (if the angle opposite to the side required be acut) but more, if it be obtuse.

		d. m.		d. m.
90.	——	Co. 60. 27.	—— Se.Co.	42. 34½.

929313.
39674.

		d. m.
Fa.	968987. a sine complement of	43. 12.

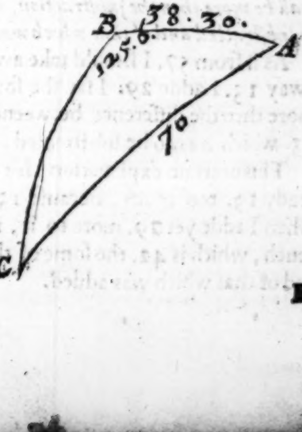
for the side B C. required.

FINIS.

Now followeth the twelue Cases of an Oblique Triangle.

The first Case.

Two sides and one opposite angle being giuen, to finde the other opposite angle.



Data. { A C. / A B. / B. } Dem. C.

By

By the 3. Axiome it is as the sines of,

AC. ——— B. ——— AB. ——— C.

Whence the Theorem is thus collected.

As the sine of the side opposite to the angle giuen, to the sine of that angle, so the sine of the side opposite to the angle required, to the sine thereof.

AC.	B.	AB.
70.	125. 6.	38, 30.
993780.	979929.	952601.
	952601.	
	6220.	

d. m.

Fa. 938750. a sine of 32. 49. for the angle C. being acut, or being obtuse it is the complement thereof to a semicircle.

I adde the sines of the second and third numbers, & the secant complement of the first together (taking for 125. deg. 6. min. the complement thereof to a semicircle) and casting away the 7. place from your right hand, for it is the totall sine, which in this worke euer comes too much, so I finde 938750. a sine of 32. degrees 49. min. for the angle C. (being acut) the thing required.

The reason of casting away the 7. place, is taken from this Lemma or Argument.

If from a number or numbers giuen, another number is to be taken, and in stead thereof a third number is added, I say the addition shall be more then the substraction, by the some made of the number to be substracted and of that which was added.

As if from 57. I should take away 13. but in stead of taking away 13. I adde 29. I say the some of 57. and 29. together, is more then the difference betweene 57. and 13. by the some of 13. which was to be substracted, and of 29. which was added.

This need no explanation, for it is euident, that the 57. is already 13. too much, because 13. was to be taken from it, and when I adde yet 29. more to it, it shall be both 13. and 29. too much, which is 42. the some of that which was to be substracted and of that which was added.

Now

Now to apply this to vse, In the last Proposition I am to take away 993780. the Log. of the first in the rule from 979929. and 952601. the second and third in the rule being added, but in stead of taking away 993780. I adde 6220. the secant complement of 70. the first, so the whole according to the *Lemma* before, must of necessity be too much by the some of 993780, the number to be substracted and of 6220. the number added, which together make 1000000. the Radius or totall sine, so the addition brings forth alwayes too much by the totall sine, wherefore in adding I leaue out the 1. in the 7. place from the right hand, and so I take away the totall sine, which was too much, and set downe only 938750. for the sine of the fourth proportionall number required, and being found in the Tables of Log. there answers to it 32. degrees 49. min. for the angle C. as before.

But the 6220. which stands in my Canon for the secant complement of 70. is not the true secant complement thereof, nor the secant of 20. for the true secants according to the making of the Log. ought to haue the totall sine 1000000. added to euery one of them throughout the whole Canon, so the true secant of 20. degrees or the secant complement of 70. degrees should bee 1006220. but I haue of purpose left out the totall sine in them all, as also in all tangents aboue 45. degrees to a good end, and agreable to the former *Lemma*, for they are better out then in, for being out as they are, the Canon of it selfe is sufficient to worke all things concerning Sphæricall Triangles by addition only, although the totall sine be not at all in the rule, nor in the first place thereof.

Yet it is in print, (by those which knew not how to make them better) that I printed my Log. with the leauing out of diuers figures (as if thereby they were made the worse,) when as themselues could be contented to embrace my forme and way, else would they neuer at their owne charge haue printed my Logarithmes a new, without adding to, or taking from them so much as 1. vnite, for they knew not how to amend them, yet cannot affoord a good word. Their intent therefore to disgrace the worke, doth rather commend the same, for could they in the least kind any wayes haue deuised how to make them but a mite better they would neuer haue printed the same againe, iust after

D my

my Coppy without any alteration at all, saue what happened through ouer-sight. Thus my enemies bare witnesse against their wills, that my forme of Logarithmes is the best. For all Logarithmes that are not made with secants, and that with leauing out the totall sine in them all, as also in all tangents aboue 45. degrees, iust as I haue done, without any alteration, are worse for vse both in right lined and Sphæricall Triangles, and cannot so redeily worke with addition only.

Yet because I did not study at *Oxford* or *Cambridge*, they may not be allowed for the best, but Logarithmes with sines and tangents only must passe for better, when as they cannot worke by them with addition only, except they make first a substraction from the totall sine, and that is called by them a *Residuum*, that it may not sauer of the name of a secant, least it should proue my inuention, when as that *Residuum* is neither more nor lesse then my secant, for that it is found the selfe same way as they are, my secants being all found by substraction of the sine complement from the totall sine, (and so is their *Residuum*) as by my Canon in euery perticular secant, aud in all tangents aboue 45. degrees appeareth, and whose Canon came first forth in print many can witnesse, for the first impression of mine was in *anno* 1619. And till the yeare after there came none forth that could worke without *plus* and *minus*, much lesse by addition only, and as yet there are not any that can doe so of themselues, but they must first make a substraction from the totall sine to get their *Residuum* (as they call it,) which being found, is neither more nor lesse then my secant. I conclude therefore, that this Canon made with secants (and in them leauing out the totall sine, as also in all tangents, aboue 45. degrees,) is the best forme of Logarithmes, for the solution of all right lined and Spæricall Triangles, and best agreeth with the Theorems, where the totall sine is in the first place: For many of them cannot be made to haue the totall sine in the first place without a secant, as amongst the Theorems before found, manifestly appeareth: thus leauing the Reader to make tryall of euery sorte, let him vpon proofe thereof say which is best. And so I proceede to the rest of the 12. Cases of an oblique Triangle.

2. Angles

2. Angles, and 1. opposite side being giuen, to finde the other opposite side.

Data { A. C. AB. } *Dem.* B C.

By the 3. Axiome it is as the sines of.

C. —— AB. —— A. —— BC.

Whence the Theorem is thus collected.

As the sine of the angle opposite to the side giuen, to the sine thereof, so the sine of the angle opposite to the side required, to the sine of that side.

Adde the sines of 38. degrees 30 min. 35. degrees 38. min. and the secant complement of 32. deg. 49. min. together, so haue you the sine of the side desired.

C.		AB.		A
32. 49.	——	38. 30.	——	35. 38.

952601.
945974.
61258.

Fa. 959833. a sine of 42. deg. for B C. being lesse then a quadrant, or the complement thereof to a semicircle being more.

The reason of this worke by addition only, is taken out of the former *Lemma* as well as of the proposition before.

The third Case.

Before I proceede further, it will not be amis to set downe this second *Lemma* or Argument, which is all one with the former saue only that it is extended to more plurality of numbers then that, and therefore more befitting the 2. next Propositions following.

Lemma 2.

If from diuers numbers giuen to be added, there should be substracted some other numbers, and in stead of taking them away, there be others added, I say the addition shall be more then the substraction by the summe of those numbers to be substracted, & of those that are added. *Example.*

As if 12. 15. 19. and 23. be 4. numbers giuen to be added together, and from that addition 9. and 11. are to be substracted, but in stead of taking them away, I adde 10. and 14. I say the addition shall be more then the substraction, by the summe of 9. & 11. the numbers to be substracted, and of 10. and 14. the numbers that were added, *viz.* by 44. for so much they make being added together. *Example.*

Numbers giuen to be added,	12, 15, 19, 23
Numbers added in stead of substracting 9. and 11.	10, 14
The totall	93
Take away,	49
So rest,	44

Numbers giuen to be added,	12, 15, 19, 23
	Fa. 69
Numbers giuen to be Substracted 9. and 11. together	20
	Rest, 49. *which take from* 93. *the former totall.*

So is left 44. *equall to the summe of* 9, 11 *To be substracted.* *and* 10, 14 *That was added.*

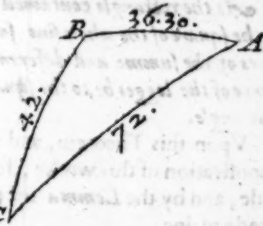
Facit. 44

Now

Now followeth the third Caſe, wherein this *Lemma*, (as alſo in the next following takes place.

The third Caſe.

The 3. ſides of an oblique Triangle being giuen, to finde any of the angles.



Data. {A B. A C. B C.} *Demand.* B.

Take alwayes the ſide oppoſite to the angle required for baſe, then take ½. the baſe, and adde to it ½. the difference betweene the legges, which are the other 2. ſides, take alſo from the ½. baſe the ſame ½. difference, ſo haue you 2. arches whoſe ſines take, and adde to them the ſecants complements of the other 2. ſides or legges, and of the whole take ½. ſo haue you the ſine of an arche, which being doubled, ſheweth the angle required.

Example.

Becauſe the angle B. is required, A C. muſt be baſe, being oppoſite thereunto, and A B. and B C. the other 2. ſides or legges.

	d.			
The baſe,	72.		The legges,	42. / 36. 30.
½. is	36.		The difference,	5. 30.
½. Diff. legs	2. 45.		½. is	2. 45.
Added,	38. 45.	953147.	Sines,	
Subſtracted,	33. 15.	939906.		
The legges,	36. 30.	51949.	Se. complement.	
	42.	40178.		
Summa,		1985180.		
½. is		992590. a ſine of 68. deg. 13. min.		

which doubled is 136. deg. 26. min. for the angle B. required.

The

The reason of this worke is taken from this Theorem following and the *Lemma* next before, which Theorem is found in my Lord of *Marchistons* booke in Latin folio 48. and in English folio 74. where it is.

As the rectangle contained vnder the right sines of the legges, is to the square of the whole sine, so shall the rectangle made of the right sines of the summe and difference of the halfe base and halfe difference of the legges be, to the square of the right sine of halfe the verticall angle.

Vpon this Theorem, and the latter *Lemma* depends the demonstration of this worke, for by the Theorem, it is set in the rule, and by the *Lemma* the reason of thus proceeding with it is made plaine.

Legs { 36. 30. — 90. — 38. 45. *the* $\frac{1}{2}$. *base & * $\frac{1}{2}$. *differ. of the legs.*
{ 42 —— 90. — 33. 15. *differ.* $\frac{1}{2}$. *base &* $\frac{1}{2}$. *differ. legges.*

Being thus set in the rule, to worke by Log. there must be added together the Log. of the 4. last in the rule, *viz.* 38. degrees 45. min. of 33. deg. 15. min. and the double of the *Radius* or totall sine and from all that substracted the Loga. of the 2. first in the rule, *viz.* of 36. deg. 30. min. & 42. deg. the remainer according to the Theorem is the double of the right sine of $\frac{1}{2}$. the verticall angle required.

I doe therefore for the arches or degrees set downe in their places their Logarithmes being taken out of my Canon as you see thus,

984051. —— 1000000. —— 953147.
959822. —— 1000000. —— 939906.

So the numbers of the seconde and third places are to be added, and those — 51949. 40178.

of the first place are to be substracted, but in steade of taking them away I adde 51949. and 40178. their secants complements, wherefore according to the latter *Lemma* the addition must be too much and more then the substraction, by the summe of the numbers to be substracted and of those that were added.

viz.

viz. By 948051. 959822. To be substracted.
and 51949 40178. That was added.

That is 2000000. the double *Radius* too much.

Wherefore when the 4. last with the secants complements of the 2. first in the rule, are all put together, the addition is too much by 2000000 the double *Radius*.

Now because the 2. middle numbers which are of those that should be added, are the double *Radius*, I am to adde 2000000. and to take away 2000000. to and from the summe of these.

953147.
939906.
51949.
40178.

Wherefore seing that which is to be added is equall to that which is to bee substracted, I leaue them both out, and neither adde any thing to, nor take any thing from the summe of these:

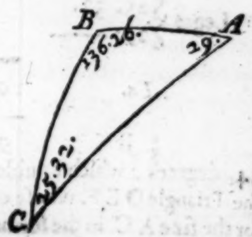
953147.
939906.
51949.
40179.

But adde them only together and they make for the double sine of ½. the angle. 1985180.

Whose ½. is, 992590.
for the sine of the ½. angle required, to which answers in the table 68. deg. 13. min. which doubled is 136. deg. 26. for the whole angle desired.

The fourth Case.

The 3. angles being giuen, to finde any of the sides.

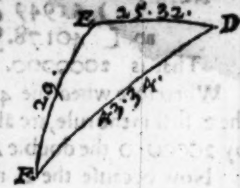


Data. A. B. C. *Dem.* AC.

If for the greater angle B. you take the complement thereof to a semicircle, *viz.* 43. deg. 34. min.

and

and make that the base, and for the other 2. sides take the angles A. and C. so is made this Triangle D E F. whose sides are the angles of A B C. the Triangle giuen, except the base D F. which is complement of the bigger angle thereof to a semicircle, and the angles of this Triangle shall be the sides of the other, except the angle E. opposite to the base DF. which shall be complement of a semicircle of the side A C. opposite to the bigger angle B. in the giuen Triangle A B C. So the angle D. in this, is equall to the side B C. in that, and F. to A B. but the angle E. is not equall to the side A C. but to the complement thereof to a semicircle, so that hauing the 3. angles giuen in the Triangle A B C. before, if you desire to finde the side A B. Then in this Triangle D E F. find the angle F. if B C. finde D. so haue you your desire, but if you would haue A C. finde the angle E. and take the complement thereof to a semicircle, and that shall be the side required.



Example.

d. m.			
Base 43. 34.		the legges	29. / 25. 32.
½. is 21. 47.		difference,	3. 28.
1. 44.		½. is	1. 44.
Added, 23. 31.	908125.	Sines.	
Substr. 20. 3.	892951.		
Legs, 25. 32.	84156.	Se. complements.	
29.	72400.		
Fa.	1957632.		

½. is 978816. a fine complement of 54. degrees, which doubled is 108. degrees for the angle E. in the Triangle D E F. whose complement to a semicircle is 72. deg. for the side A C. in the former Triangle A B C. the thing required.

The

The reason of this, is taken from the Theorem and *Lemma* next before, as well as of the third Case, therefore needlesse to make further repetition thereof.

Now follow the 8. other Cases of an oblique Triangle, of which euery one requires 2. additions, and cannot be wrought at lesse, I will therefore onely set downe the Theorems, and resolue the Triangles thereby, that the Reader may see the comly order of this Canon made with secants, which for all vses is the best, and cannot be parraleld by any other, except they be made after the same manner without any alteration, else they will not be so ready.

The fifth Case.

2. Angles and the side betweene them being giuen, to finde the third angle.

For the Propositions following, there are perticular rules to be giuen, whereby may be knowne, whence the perpendicular must fall, and which way the side wheron it falleth (if need require) must be increased, with some other obseruations.

But not intending here to make a large discourse of these things, I haue reserued them and their vses with many more breefe wayes for another time: yet to giue the Reader some content therein, I will prescribe 2. generall rules.

The first is,

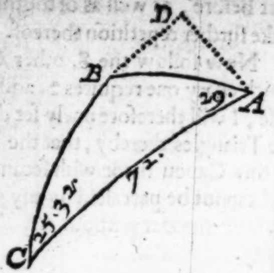
To draw your Triangle giuen, as neere as you can true, to agree with the Globe.

The second.

So, to let fall your perpendicular, and to increase your side, as you may in the right angled Triangle made, make knowne to your selfe 3. things.

These rules may be sufficient, except in this, *where 2. sides and 1. opposite angle is giuen, to finde the 3. side, or the angle betweene them*, where they may also suffice, vnlesse the other opposite angle be so neere a right angle, that it is not descerneable on the Globe, whether it be acut or obtuse, in that case it will require to haue the quality thereof knowne, which being the same as the angle giuen, the first and 2. arches are to be added, or being different, they are to be substracted, so haue you the side or angle required.

Data: $\left\{\begin{array}{c}A.\\C.\\AC.\end{array}\right\}$ demaund. B.



Increase C B. and let fall the perpendicular. A D. then,

As the totall sine to the tangent of C. so the sine complement of AC. to the tangent complement of C A D.

C. AC.
90. —— T. 25. 32. —— Co. 72.

926121.
882564.

Fa. 808685. a tangent complement of 81. degrees 36. min. for the angle C A D. from which take 29. deg. the angle C AB. so is left 52. 36. for the angle BAD. then,

As the sine of C A D. to the sine complement of C. so the sine of B A D. to the sine complement of A B D.

CAD. C. BAD.
81. 36. —— Co. 25. 32. —— 52. 36.

989723.
976985.
1079.

Fa. 967787. a sine complement of 43. deg. 34. min. for the angle A B D. whose comple. to a semicircle is 136. deg. 26. min. for the angle A B C. required.

Which may also be found if you doe but adde 90. deg. the whole quadrant to 46. deg. 26. min. which in the sines answeres to 967787. before found.

To shew the Demonstration of this worke, and how the Theorems

rems for this & all the following Propositions are made, were not amisse in this place: but my intention being only to make known to the Reader, the readines of this forme of Loga. made with secants, aboue all others, doe omit the same for this present, and reserue that and many other extraordinary brefe rules in all parts of the Mathematickes, for those that will be pleased to become my schollers, to whome I shall giue such satisfaction in this and other short wayes, that they shall not need to goe to any other Teacher for further instruction therein.

Yet to satisfie in part the learned, that I can giue a reason for what I doe, I will set downe the making of these 2. last Theorems, whereby they may (if so they please) suppose I can doe as much for the rest, and whether some of them doe or no, I passe not greatly, for that they are sorry I can doe so well, not hauing seene one of the Vniuersities.

Yet is it not vnknowne to diuers well seene in the Mathematickes, that not for these breefe rules only, but for diuers other short wayes, I can doe as much and more, then they haue seene by some others that thinke better of themselues, and to make it somewhat apparant to be so, I doe let the Reader vnderstand, that I haue a Triangular table of my owne inuention, wherewith I can by addition only resolue any of these oblique Triangles, at one or two operations without any Theorems, , or setting it in the rule at all, or without increasing any of the sides, or letting fall a perpendicular: and yet certainely tell, when, and where, after the first or second rule is made, to know whether the arche found must be added or substracted, which can no way without my afore-said table or the like, so readily and certainely be knowne, for in working by it, I doe no more then set A B C. to my Triangle giuen, and at first sight am directed thereby what numbers to take out of my Canon, to finde my first and second arches, as also whether it requires addition or substraction, without any premeditation, delaye, or losse of time at all, whose vse is so ready in the Propositions of both the Globes and for Nauigation, that those which know it, doe refuse all other wayes to worke thereby.

And so I proceed to the Demonstration of the 2. last Theorems before mentioned.

Hauing increased the side C B. to D. and let fall the perpendi-

cular A D. In the right angled Triangle A D C. is knowne the ſubtendant ſide A C. 72. deg. & the oblique angle C. finde therefore by the Theor. of the ſecond Caſe of right angled Sphæricall Triangles, before ſet downe at the beginning of this Treatiſe, the other oblique angle C A D. thus,

90. —— *T*. C. —— *Co*. A C. *Fa. T. Co. C A D.*

Whence the firſt of the 2. Theorems before mentioned is thus collected.

As the totall ſine to the tangent of C. ſo the ſine complement of A C. to the tangent complement of the angle C A D.

Then take from C A D. being found, the angle C A B. ſo reſt the angle B A D. of the leſſer Triangle A D B. Againe in the bigger Triangle C A D. hauing the 2. oblique angles C. and C A D. before found, finde by the firſt Theorem of the 16. Caſe of right angled Sphæricall Triangles, the ſide A D. thus.

C A D. —— *Co*. C. —— 90. *Fa. Co*. A D.

Then hauing A D. (for this rule if it were wrought would finde it,) becauſe it lyeth ſecretly incloſed therein, and will not appeare except the rule be wrought, but that needs not, for it is there in *potentia*, therefore accounting it as knowne, then in the leſſer Triangle A D B. haue you one containing ſide *viz*. A D. in *potentia*, and the angle B A D. before found: Finde therefore by the Theorem of the 7. Caſe of right-angled Sphæricals, the angle A B D. oppoſite to that ſide thus,

90. —— *Co*. A D. —— B A D. *Fa. Co*. A B D.

Now ioyning theſe 2. laſt rules together, being by the 16. and 7. Theorems before mentioned thus ſet downe,

$$\text{Theor.}\begin{cases} 16.\ \text{C A D.} — \textit{Co}.\text{C.} — \cancel{90}. —— \textit{Co}.\ \text{A D.} \\ 7.\ \cancel{90}. — \qquad \text{B A D.} —— \textit{Co}.\ \text{A B D.} \end{cases}$$

It will plainely appeare how the latter of the 2. Theorems is made.

For as much as 90. is to be added and 90. to be taken away, I put them both out, ſo then it ſtands thus in the rule.

C A D. —— *Co*. C. —— B A D. —— *Co*. A B D,

Whence the ſecond Theorem is thus collected.

As the ſine of C A D. to the ſine complement of C. ſo the ſine of B A D. to the ſine complement of the angle A B D.

Which is complement to a ſemicircle to the angle A B C. required,

quired, and after this manner are made all the other Theorems following with some little alteration: Perhaps this may not fully satisfie the vnlearned: Yet to the learned I am sure they may hereby gather the order of making these Theorems, which if any others doe not vnderstand, if they will be pleased to repaire vnto me I will giue them further satisfaction herein, as also in many other breefe rules more then ordinary.

The sixt Case.

2. Angles, and the side betweene them being giuen, to finde any of the other sides.

$$\textit{Data.}\left\{\begin{array}{c} A. \\ C. \\ AC. \end{array}\right\} \textit{Demaund.}\ AB.$$

In the former Triangle it is.

As the totall sine, to the tangent of C. so the sine complement of A C. to the tangent complement of C A D.

	d. m.	AC.
90. ——	T. 25. 32. ——	Co. 72.

926125.
882564.

Fa. 808689. a tangent complement of 81, deg. 36. min. for the angle C A D. from which take C A B. so rest 52. deg. 36. min. for B A D. then,

As the sine complement of C A D. to the tangent complement of A C. so the sine complement of B A D. to the tangent complement of A B.

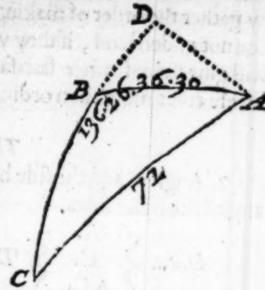
CAD.	AC.	BAD.
Co. 81. 36. ——	T. Co. 72. ——	Co. 52. 36.

887582.
950139.
192358.

Fa. 30079. a tangent complement of 36. degrees 30. min. for A B. required.

2. Sides and one opposite angle being giuen, with the quali-litie of the other opposite angle, to finde the angle betweene them,

Data. { AB. AC. B. C. } Deman. A. being acut,



Increase CB. and let fall the perpendicular AD. then,

As the totall sine to the tangent of A B D. so the sine complement of A B. to the tangent complement of B A D.

ABD.		AB.
90. ——	*T.* 43. 34. ——	*Co.* 36. 30.

994995.
978167.

Fa. 973162. a tangent complement of 52. degrees 36. min. for the angle B A D. of the lesser Triangle A D B. then,

As the tangent complement of A B. to the sine complement of B A D. so the tangent complement of A C. to the sine complement of C A D.

AB.	BAD.	AC.
T. Co. 36. 30. ——	*Co.* 52. 36. ——	*T. Co.* 72.

950139.
887592.
969884.

Fa. 807615. a sine complement of 81. deg. 36. min. for the angle C A D. from which take 52. deg. 36. min. the angle B A D. before found, because C. is acut and B. obtuse,

B. obtuse, but if both be acut or obtuse the angles C A D. and B A D. must be added, so rest 29. deg. for the angle B A C. betweene the giuen sides, the thing required.

The eighth Case.

2. Sides and 1. opposite angle being giuen, with the qualitie of the other opposite angle, to finde the third side.

Data. { A B. A C. B. C. } *Demaund.* B C. being acut

In the last Triangle it is

As the totall sine to the tangent complement of A B. so the secant of the angle A B D. to the tangent complement of B D.

	AB.	ABD.
90. ——	T. Co. 36. 30. ——	Se. 43. 34.

30116.
32217.

Fa. 62333. a tangent complement of 28. degrees 12. min. for B D. then,

As the sine complement of A B. to the sine complement of B D. so the sine complement of A C. to the sine complement of C D.

AB.	BD.	AC.
Co. 36. 30. ——	Co. 28. 12. ——	Co. 72.

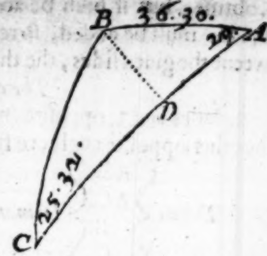
987365.
882564.
21833.

Fa. 891762. a sine complement of 70. deg. 12. min. for C D. from which take 28. deg. 12. min. B D. before found (for that of the angles C. and B. the one is acut and the other obtuse) so is left 42. degrees for the side B C. required.

The ninth Case.

2. Angles, and 1. opposite side being giuen, to finde the side betweene them.

Data.



Data. $\left\{\begin{array}{l}A.\\C.\\AB.\end{array}\right\}$ Dem. A C.

Let fall the perpendicular B D.

then,

As the totall sine, to the tangent complement of A B. so the secant of A. to the tangent complement of A D.

	AB.	A.
90. ——	T. Co. 36. 30. ——	Se. 29.

30116.
13397.

Fa. 43513. a tangent complement of 32. degrees 55. minuts for AD. then,

As the tangent of C. to the tangent of A. so the sine of A D. to the sine of C D.

C.	A.	AD.
T. 25. 32. ——	T. 29. ——	32. 55.

940997.
939012.
73879.

Fa. 953888. a sine of 39. deg. 5. min. for C D. to which adde 32. degees 55. min. A D. so haue you 72. degrees for the side A C. required.

The tenth Case.

2. Angles, and 1. opposite side being giuen, to finde the third angle.

Data. $\left\{\begin{array}{l}A.\\C.\\AB.\end{array}\right\}$ Demaund. B. or A B C.

In the last Triangle let fall the perpendicular BD. then,

As the totall sine, to the tangent of A. so the sine complement of A B. to the tangent complement of A B D.

A. AB.

90. ——— *T.* 29. ——— *Co.* 36. 30.

940997.
978167.

Fa. 919164. a tangent complement of 65. deg. 59. for the angle A B D. then,

As the sine complement. of A. to the sine of A B D. so the sine complement of C. to the sine of C B D.

A. ABD. C.

Co. 29. ——— 65. 59. ——— *Co.* 25. 32.

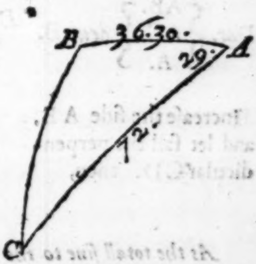
990945.
989723.
13397.

Fa. 994065. a sine of 70. deg. 27. min. for the angle C B D. to which adde 65. deg. 59. min. the angle A B D. before found, so haue you 136. deg. 26. min. for the angle A B C. required.

The eleuenth Case.

2. Sides, and the angle betweene them being giuen, to finde the 3. side.

Data. { AB. AC. A. } *Dem.* BC.



Let fall the perpendicular B D. then,

As the totall sine, to the tangent complement of A B. so the

the secant of A. to the tangent complement of A D.

AB. A.

90. —— T. Co. 36. 30. —— Se. 29.

30116.
13397.

Fa. 43513. a tangent complement of 32. deg. 55. min. for A D. which take from 72. deg. A C. so is left 39. deg. 5. min. for C D. then,

As the sine complement of A D. to the sine complement of A B. so the sine complement of C D. to the sine complement of B C.

AD. AB. CD.

Co. 32. 55. —— Co. 36. 30. —— Co. 39. 5.

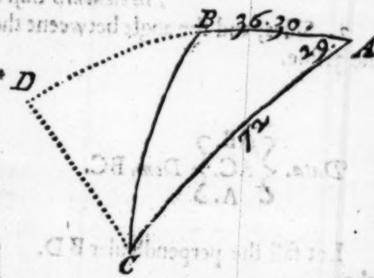
978167.
974669.
17499.

Fa. 970335. a sine complement of 42. deg. for the side B A. required.

The twelfth Case.

2. Sides, and the angle betweene them being giuen, to finde 1. of the other angles.

Dat. { AB. AC. A. } *dem.* B.



Increase the side A B. and let fall the perpendicular C D. then,

As the totall sine to the tangent complement of AC. so the secant of A. to the tangent complement of A D.

A C.		A.
90. ——	*T. Co.* 72. ——	*Se.* 29.

887582.
13397.

Fa. 900979. a tangent complement of *69.* deg. 37. min. for A D. from which take 36. deg. 30. min. A B. so rest 33. deg. 7. min. for B D. then,

As the sine of D B. to the tangent of A. so the sine of A D. to the tangent of the angle D B C.

D B.	A.	A D.
33. 7. ——	*T.* 29. ——	69. 37.

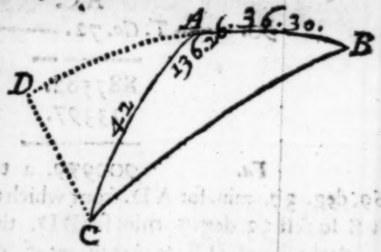
940997.
993534.
60450.

Fa. 994981. a tangent of 43. degrees 34. min. for the angle D B C. whose complement to a semicircle 136. degrees 26. min. for the angle A B C. required.

Note that in euery of these 8. Cases where I haue vsed addition, of the first and second arches, it may be so put that substraction of them must be made, and where I haue substracted I can put it so, that it shall require addition, as I will instance in this last example wherein A B. A C. and the angle A. is giuen, and it is required to finde the angle B. I put it thus, I giue A B. and B C. with the angle B. of the same Triangle, and I desire the angle A. To make all the former Theorems to hould, how soeuer it be put, obserue this order, letter it according to the former *Data*, as in the last Example is giuen, { AB. AC. A. } and B. is required.

therefore drawe your Triangle and set vpon it the numbers giuen thus.

 Then



Then for as much as according to the *Data* A B. A C. with the angle A. is giuen, and the angle B. is required, set B. in this, at the angle required, & A. at the angle giuen, then C. must be at the other angle, so shal you haue giuen according to the *Data* A B. A C. A. and B. is required, then as in the last example the perpendicular C D. fals from C. on B A. so shall it here B A. being increased, & as there is found by the first Theo. A D. so by the same is found here. A D. from which there is taken A B. to get B D. to which here is added A B. to get BD. then as there, by the second Theo. is found DBC. so by the same is here found DBC. the thing req. the like in others, &c.

As I haue here found 1. of the vnknowne angles with 2. additions, so there is a way to finde both the angles at 2. workes and that after this manner.

Take ½. the summe of the sides, ½. the difference of the sides, and ½. the angle.

Then by the ½. summe set downe first his secant complement, then his secant, by the ½. difference set first his sine, then his sine complement, and by the ½. angle his tangent complement twise, as here you see.

½. Sum of the sides	54. 15.	*Se Co.*	20878.	*Se.*	53743.
½. Diff. of the sides	17. 45.	Sine.	881211.	*Si. Co.*	995123.
½. Angle	14. 30.	*T. Co.*	135240.	*T. Co.*	135240.
		Fa.	37329.	*Fa.*	184106.

Then adde them as you see, and the first addition 37329. is the tangent of 55. degrees 27. min. for ½. the difference betweene the 2. vnknowne angles and the second addition 184106. is the tangent of 80. deg. 59. min. for ½. the summe of them, to which adde 55. 27. the ½. difference, so haue you 136. deg. 26. min. for the bigger vnknowne angle, & from which take also 55. *d.* 27. *m.* so is left 25. *d.* 32. *m.* for the lesser vnknowne angle the things requ.

In.

In like sorte may you in the 5. Propositions before of oblique Sphæricall Triangles, where the 2. angles and the side betweene them is giuen, finde by 2. additions the other 2. vnknowne sides, as followeth.

Take ½. the summe of the angles, ½. the difference of them, and ½. the side giuen; then by the ½. summe set as before the secant complement, and also the secant, by the ½. difference the sine and sine complement, but by the ½. side the tangent twise, as here you see, as I will instance vpon the example of the 5. Case of these oblique Triangles before set downe, where the 2. giuen angles are 25. degrees 32. min. and 29. deg. and the side betweene them 72. degrees.

Angles, { 29. / 25. 32.

Summe,	54. 32.	½. is 27. 16.	*Se.Co* 78060.	*Se.* 11779.
Differ.	3. 28.	½. is 1. 44.	Sine, 650167.	*Co.* 999954.
Side,	72. —	½. is 36. —	*Tan.* 968054.	*T.* 968054.
			Fa. 696281.	*Fa.* 979787.

The first addition 696281. is the tangent of 2. deg. 45. for ½. the difference betweene the vnknowne sides, the second addition 979787. is the tangent of 39. deg. 15. min. for the ½. sum of them, to which adde 2. degrees 45. min. so haue you 42. deg. for the bigger vnknowne side, and from which substract also the said 2. deg. 25. min. so is left 36. deg. 30. min. for the lesser vnknowne side the things required.

The reason of this breefe way, and of many others in seuerall parts of the Mathematickes, I shall be ready to impart vnto all those that will be pleased to repaire vnto me for instructions therein.

And how vsefull they are in the solution of both kindes of Triangles, *viz.* right lined and Sphæricall, as also in the Propositions of both the Globes, will appeare when tryall thereof shall be made, but especially in Nauigation: wherein my Triangular Table before spoken of, takes great place, for thereby one may keepe a better account of the ships way, for course and distance,

then by any Chart, either plaine or made after *Mercator*, and more iust and true then by either of them: For to worke by that, is true great circle sayling, and agreeth euery way with the Globe to a minute, which no other way can doe, for euen by *Mercators* Chart in the baring of 2. places, there will appeare a manifest error of whole degrees being compared with the Globe: But this way of great circle sayling is the only absolute and true way of keeping a course or reckening, and can no way be contradicted, no, not by the Globe it selfe, but in all points, Cases, and Demandes whatsoeuer, shall stand firme & true, & by my said triangular table is very reddily performed with addition only: And herein there is no need of the Table of Rumbs, or of the gradiation of the meridian, but onely of my Canon of Logarithimes, which for all vses conserning both the Globes is more then sufficient. I haue also another Logarithmy for equall parts agreable to this which I printed 4. yeares agoe, whose vse is very great in *Arithmetick*, and *Geometrie*, for the solution of Geometricall Problemes and Arithmeticall Questions, the breefest and easiest wayes, more readily then by any Logarithmes as yet set forth, and for proofe thereof I will here instance vpon this Geometricall Probleme.

Hauing only the 3. sides of a right-lined Triangle giuen, to finde aparte and seuerally (without first finding one thing and then an other thereby) euery of these Demandes: viz. First the parts of the base cut, by a perpendicular let fall from the angle opposite thereunto, then the perpendicular, the area, any of the angles, the Diameter of the inscribed, and of the circumscribed circle, I say each a parte perse, *being presently demanded for any one of them.*

I will only set downe the numbers to euery one appartaining, being taken out of my Table, that any one may compare them together being wrought by any other forme of Loga. and so iudge himselfe which requires least worke or fewest numbers, so shall it need no further commendations: and I doe assure thee, herein, is not vsed any mentall substraction from or out of any number to get any of these set downe, but may all of them be found in my Logarithmes.

If any doubt thereof, let him repaire to me, and hee shall see this and much more performed by them. They are also most ready for interest, after any rate *pro cent*, for yeares, months,

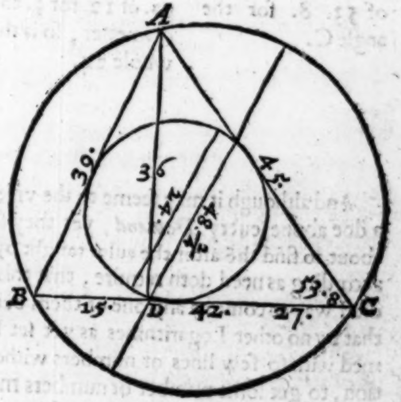
and dayes : Also thereby women or children may in a short time learne to cast vp any vsuall question for buying or selling, as if 1. elle cost 17. s. 3. d. 1/4. what 759. 1/4. elles : it will cast vp such a one or the like, with two additions to a farthing, and quickly attained euen by children.

Data, The 3. sides AB. AC. BC. } *Demand* as afore said,

For the parts of the base B D. and D C.

44308.
17918.
62623.

Fa. 24849. a Log. of 12. which taken from 42. the base leaueth 30. whose 1/2. is 15. for AD. so is DC. 27.



For the area.

20716.
14452.
15223.
15890.

Fa. 66281.
a Log. of 756. for the area required.

For the perpendicular AD.

20716.
14452.
15223.
15890.
69555.

Fa. 35836. a Loga. of 36. for the perpendicular required.

For

For the angle C.	For the diametter of the inſcribed circle.	For the diametter of the circumſcribed circle.
20716.	29284.	29284.
14452.	14452.	35548.
15223.	15223.	34777.
15890.	15890.	34110.
69555.		36636.
61933.		38066.
		30445.
Fa. 97769. a ſine of 53. 8. for the angle C.	*Fa.* 24849. a Loga. of 12. for ½. the diametter, ſo is the whole 24.	*Fa.* 38866. a Loga. of 48. ¼. for the diametter requi.

And although it may ſeeme to the vnlearned, that here is much a doe aboue euery *Demand*, yet they ſhall perceiue if they goe about to find thē after the rules taught by others at 2. or 3. works according as need doth require, that this is the ſhorteſt and reddieſt way to come to any one of them being ſuddenly deſired, and that by no other Logarithmes as yet ſet forth they can be performed with ſo few lines or numbers without ſome mentall opperation, to get ſome number or numbers more then their Logarithmes can aford: I could finde all of them much breifer if I might worke vpon ſome thing already found, as giue me the area and I will finde the perpendicular with only adding of 2. numbers together, or giue me the perpendicular, and with 2. numbers taken out of my Table I will giue you any of the angles adioyning to the baſe: or giue the area, and I will giue by adding together onely 2. numbers found in my Table the ½. diameter of the inſcribed circle, or the perpendicular, and with 3. numbers taken out of my Table, I will giue you the diametter of the circumſcribed circle.

Theſe and many other briefe rules in diuers Geometricall operations (whereof I purpoſe to write a perticular Treatiſe) cannot be performed by any other Logarithmes as yet ſet forth with ſo few lines or numbers, except they vſe ſome mentall ſubſtraction

or

or diuiſion, which will both ſpend time & be more ſubiect to error.

Thus courteous Reader haſt thou here a ſmall Pamphlet which I account but an introduction to the Mathematickes, yet if thou be a true louer thereof, and haſt a further deſire to increaſe thy skill therein; If thou wilt be pleaſed to repaire vnto me, thou maiſt be inſtructed after the breefeſt rules and wayes that Arte can aford, not in this alone, but in all theſe parts of the Mathematickes following, *viz.* in Arithmeticke in,

Whole numbers and fractions, with ſuch breefe wayes in euery rule, as hath not bene taught by any: with many compendious rules of exchange, intereſt, and the Italian *practicke, for Marchants, Mintmaſters, Gold-ſmiths, and other Tradeſmen, moſt fitting and neceſſarie.*

In Proportions, from which may moſt clearely and demonſtrably be drawne the reaſon of making the Logarithmes.

The extraction of all kindes of rootes, viz. *ſquare, cube, biquadrat, ſurſolid, &c. with the making of a perticular* Clauis *or key, to ſhew the reaſon of ſuch proceeding therein, as in their operation is required.*

The extraction of all kind of roots by Logarithmes, with the finding of ſo many meane proportions (betweene any 2. extreames giuen) as ſhall be required: and to giue inſtantly the 1. 2. 3. or 4. meane, &c. deſired, without finding them in order, but which you pleaſe firſt, and preſently.

The rule of Coſſe or Algebra, *after the moſt learned manner, reſoluing the Demands thereof by letters,* viz. *ABC, &c. whereby it is inſtantly brought to the Æquation.*

The performance of many queſtions of Algebra *by the rule of falſe Poſitions only, formerly eſteemed impoſſible to be anſwered except by* Algebra, *hetherto not taught by any.*

The valuing of lands, leaſes, annuities or rents, with new ſcales and rules by me inuented for the more ſpeedy performance thereof.

Geometrie in

Longemetria, Planimetria, *and* Solidimetria, *by demonſtration out of* Euclid, *with perticular reductions, and abreuiations therein, whereby the learner may more ſpeedily attaine the ſame.*

Suruighing of lands, by ſeuerall inſtruments, and plotting the ſame ſun dry wayes.

Altering of Maps or plots to a greater or lesser proportion and that severall wayes.

Taking of hights and distances by severall instruments on sea or land, with some perpticular new inventions therein for more true and exact observation.

Measuring of board, glasse, wainscot, timber, stone, and gaudgeinge all kinds of vessels, with perticular roddes, rules and scales, now newly by me invented, for the speedy performance thereof.

Fortification *after the* Italian, French *or Low-Countrie manner, also with the Arithmeticall opperation thereof, for finding any line or lines therein, by addition only.*

Geographie.

With the vse of generall and perticular Maps thereunto appartaining.

Astronomie in.

Calculating the motions and aspects of the Planets, for any time past, present, or to come.

The practise thereof, for the solution of any Proposition of both Globes, either by Proiection with scale and compasse, or Arithmetically by the Sphaericall Triangles which is best of all, and that with addition only.

The vse of the Ephemerides, for erection of the Horiscope.

Dialling *of divers kinds, with the placing of the signes of the Zodiacke, the* Almicanters, Azimuths, *and many other shadowes in them: All by good and iust Demonstration, also the Arithmeticall operation thereof (by addition only) whereby they are most exact and iustly made, for all places and Elevations.*

Navigation.

With the vse and making of sea Charts, either planie or after Mercator.

By great circle sailing which is best of all, whereby a more iust and true account for course and distance may be kept, without any Sphare Globe, Mappe or Charte whatsoever, then by any of them, and quickly and most easily performed, and that arithmetically with addition only, by a new invention of mine

With the vse of divers new invented propositions for finding the Elevation of the Pole, Azimuth, *and variation at any time, by day or night, though the Sunne or Starre be not vpon the Meridian.*

With

With directions and instructions for the vse and making of diuers kind of Instruments, Scales and Rulars, and how to set vpon them any possible kind of gradiation required, whereby they may be more certaine and ready for vse then many of them now are, *viz.* of,

The Mathematicall Seale, Rular, Sector Proportionall compasses, Staffe, and Crosse staffe, Theodolite, Astralabe, Hemisphære, *Plame-Table, Circumferentor*, Perractor *and* Protractor, *both for sea and land, with other like inuentions for any perticular vse or vses: As also how to gradiate a Quadrant, by which obseruing the Sunne or Starre forewards or backewards, you may finde the Eleuation at first, not knowing the declination of the Sunne or Starre, nor respecting the same.*

These and all other Mathematicall Instruments are made with the newest inuentions, in brasse by Master *Elias Allen* in the *Strand*, and in wood by Master *Iohn Tomson*, in *Hosier-lane.*

And for the more speedy attaining hereunto, youth and others may be bourded and taught by the Professor hereof, dwelling in *Queenes*streete, on the backside side *of Drury-lane.*

There may you also haue this Treatise, as also his Geometricall Extraction, and of the best Mathematicall *Paper.*

Likewise all such strangers as cannot speake or vnderstand English, may by this Professor be instructed in the Mathematickes in *Italian, French or Dutch, &c.*

FINIS.

Glory bee to God on high, and peace in earth, and towards men good will.

3

A GEOMETRICALL EXTRACTION, OR A COMPENDIOVS COLLECTION

of the Chiefe and choyſe Problemes,

Collected out of the beſt, and lateſt Writers.

VVHEREVNTO IS ADDED,

about 30. Problemes of the Authors Inuention, being for the moſt part, performed by a better and briefer way, *then by any former Writer.*

By IOHN SPEIDELL, *practitioner in the Mathematicks, and profeſſor thereof in London.*

LONDON,

Printed by *Edward Allde*, and are to be ſolde at the Authors houſe in the fields betweene Princes ſtreete and the Cockpit.

1617.

TO THE HONORABLE

KNIGHT SIR IOHN EGERTON, HEIRE *apparant to the right honorable* Thomas *Lord* Ellesmere, *Lord high Chancelor of England.*

SIR,

I should not so boldly aduenture, to shrowd this weak work of mine vnder your worthy Patronage, were I not assured, that as in your iudgement you are able to discerne, so in your noble disposition, you will fauorably accept these first fruits of mine: In which kinde it hath pleased you some time to haue had conference with me, hauing to your bountifull rewards been pleased to adde a plentifull report of your good opinion had and helde of me. Conscerning the worke it selfe, though it be little, yet I hope it will appeare both for the matter and manner, greater in value then in volume, contayning of the chiefest things, partly collected out of others,

 and

and partly of my owne, and performed by a more speedy way then by any former Writer. Infine whatsoeuer the booke is or shall be, I esteeme it too little, to expresse my thankfull minde for your many fauours, wherein I shall euer be studious to supply my other wants, by my best endeuours, and euer rest, At

Your honourable disposition,

Io: Speidell.

To the Reader.

CVrteous Reader, Hauing for these tenne yeares space, bene a professor of the Mathematickes in this Cittie, during which time, I haue instructed many Gentlemen and others (in Arithmeticke, Geometrie, Astronomy, And also, haue perused all the best anthors, that I could get, in Latine, Italian, French, English, high Duch, and Flemish, and not hauing found this part which I here present to thy view, (consisting of the best, choyse, and most artificiall Problemes) so amplie, and after so breife a way performed by any: It hath made me therefore the more bolde to present it before thee, wherin I haue indeauoured to be briefe, knowing that much superfluitie of words doth more let and hinder, then any way further, or aduance the matter, yet not so briefe, as thereby to obscure or darken the worke in any kinde, but to make it the more cleere, easie, and plaine to the reader, and for the better satisfaction of such as desire the demonstration of euery thing. I haue ~~con~~ quo=ted in the margent such places of Euclide *as tend thereunto, and for a further light, haue in the most principall places set Arithmeticall numbers by the Diagrams, whereby such as are desirous to make triall that way, may finde satisfaction. And not only these Problemes contained in this booke (well-beloued Reader) but much more viz. in Arithmeticke, Geometrie, Astronomie, Nauigation, Surueighing, fortification, achitecture, taking of heigths & distances, and all other parts of the Mathematicks, &c. may be performed by a Mathematicall*

ticall Scale. now newly (this present yeare) by me inuented, farre beyond my former Scale made in Anno. 1607. *the which with all other Mathematicall instruments, are made by my louing friends* Mr Elias Allen, *ouer against* St. Clements *Church in the Strand, in* Brasse; *and* Mr. Iohn Tomson *in Hosier lane by Smithfield (in Wood) and may also both in Wood and Brasse be had, with the instructions therof by me at my house: Thus desiring thee friendly Reader to peruse this worke with iudgement, and not rashly to speake euill of him that hath not harmed thee, but taken much labour and paines day and night to compose, collect, and peruse this work for thy good: so shalt thou walke charitably, and giue me occasion to deserue thy further loue, in setting forth a second part, The which I promise to performe God willing, as I shall perceaue this to be respected, and so for this time I rest, remaining,*

Thy louing friend

I. Sp.

A GEOMETRICALL EXTRACTION,

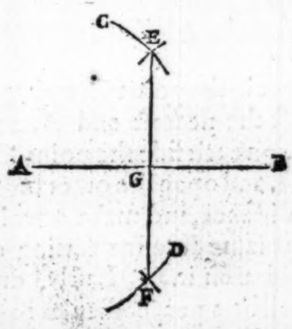
Teaching the Construction of diuers of the most choise and chiefe Probleames.

Verie profitable, & in performance most pleasant and delightfull.

Probleme I.

To deuide a line giuen into two equall parts at right angles.

Let A B. be a line giuen to be so deuided.



FIrst set one foot in the end A. and opening the other foot at pleasure to aboue halfe the line AB. make the arches C &D. aboue and belowe, then with the same distance setting one foot in the other end B. crosse those arches in E. and F. Lastly drawe the 10. 1.

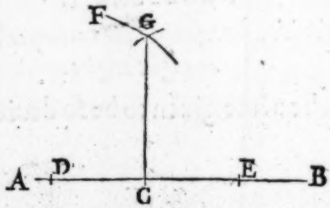
 line

line E F. which ſhall deuide the line A. B. into two equall parts in G. as was required.

Prob. II.

Vppon a point in a line giuen, to erect a perpendicular.

Let A.B. be a line giuen, and let C. be a point aſſigned therein, whereuppon it is required, to erect a perpendicular.



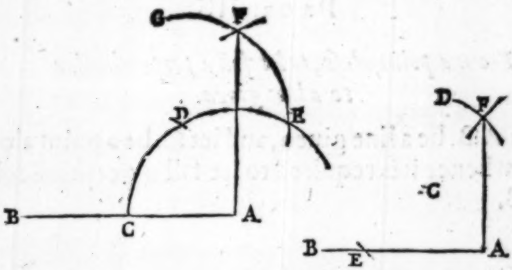
First ſet one foot in the point C. and open the other foot to almoſt the neereſt end A. and make the points D and E. on each ſide the point C. That done ſet one foot in D. and open the other foot at pleaſure
I.I. to ſome wyder diſtance, and make ouer head the arch F. Then with the ſame diſtance ſetting one foote in E. Croſſe the ſaid arch in G. Laſtly, drawe the line G. C. which ſhall be a perpendicular to A. B. vppon the point C. required.

Prob. III.

To erect a perpendicular vppon the end of a line.

Let A. B. be a line giuen, and let it be required to erect a perpendicular vppon the end A.

Set



SEt one foot in the end A. and opening your Compasses at pleasure, make the arch CDE. Then with the same distance setting one foot in C. crosse that arch in D. that done, keep one foot in D. and make with the other, the arch E G. Then set one foot in E, and with the same distance crosse the said arch E G, in F. Lastly, drawe the line F A. which shall be a perpendicular vpon the end A of the line A B. which was required.

Another way.

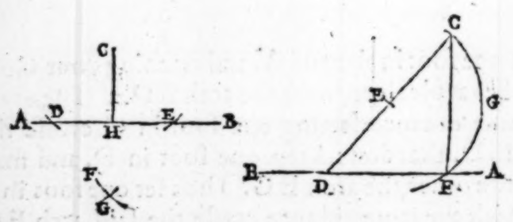
AGaine, let in the last *Diagram* on the right hand A B. be a line giuen, and it is required vppon the end A. thereof, to erect a perpendicular.

Set one foot in the end A. and with the other take a point at pleasure as C, then keeping one foot in C. make aloft the arch D. and crosse also the line A B. in E. That done, lay your Rular by the points E C. and where it crosseth the arch D set F. Lastly drawe the line F A. which shall be a perpendicular to A B. vpon the end A. as was required. 31. 3.

Prob: IIII.

From a point aloft, to let fall a perpendicular to a line giuen.

Let A B. be a line giuen, and let C. be a point aloft, from whence it is required to let fall a perpendicular to AB.



SEt one foot in C. and opening the other foot almoſt to the neereſt end A. make in the line AB, the markes D. and E. Then ſet one foot in E. and with
12,1. the ſame diſtance make vnderneath the arch F. ſet alſo one foot in D. and croſſe the ſide arch F. in G. Laſtly, lay your Rular by the points C G. and drawe the line C H. which ſhall be a perpendicular to AB. from the point C. according to your deſire.

Another way.

AGaine, in the laſt *Diagram*, on the right hand, Let AB. be a line giuen, & let C. be a point aloft, from whence it is required to let fall a perpendicular to A B.

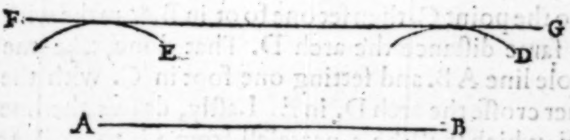
Laye

Laye the Rular by the point C. and any part of the line A B. as D. and drawe the line C D. which deuide into two equall parts in E. then keeping one foot 313 in E. with the distance E C. make the arch C G F. to cut A B. in F. Lastly, drawe the line C F. which performeth the demaund.

Prob. V.

To drawe a Parralell to a line giuen.

Let A B. be a line giuen, whereunto it is required to drawe a Parralell.

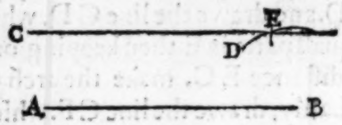


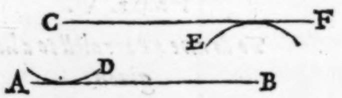
SEt one foot in the end A. & opening the other foot at pleasure, make ouer head the arch E. Then with the same distance, Setting one foot in the other end B. make the arch D. Lastly, lay your Rular by the tippes of those arches, and drawe the line F G. which shall be a Parralell to A B. as was required.

Prob. VI.

To drawe a Parralell to a line giuen, from a point assigned.

Let A B. be a line giuen, and let C. be a point assigned, from whence a parralell is to be drawne to A. B.





SEt one foote in the end A. and extend the other to the point C. then set one foot in B.& make with the same distance the arch D. That done, take the whole line AB. and setting one foot in C. with the
31.1. other crosse the arch D. in E. Lastly, drawe the line CE. which shall be a parralell from C, to AB. as was required.

Another way.

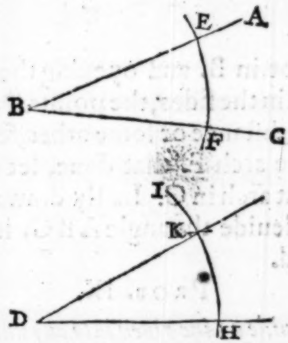
AGaine, in the former *Diagram* belowe, let AB. be a line giuen,& C. a point assigned, from whence it is required to drawe a parralell to AB.

Set one foot in C. and taking the shortest distance to AB. make the arch D. to touch the line AB. Then with the same distance setting one foote in the end B. with the other make the arch E. That done, lay your Rular by the point C. and the tippe of the arch E. and drawe the line C.F. which shall be a parralell to AB. as was required.

Prob. VII.

To make an angle, Equall to an angle giuen.

Let A B C. be an angle giuen. And it is required to make another angle equall thereunto.



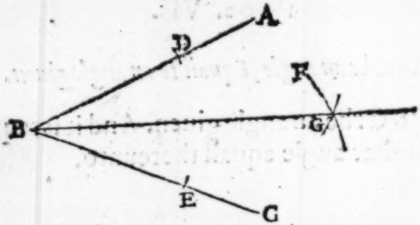
First drawe any where a line as D H. Then setting one foot in the angle B. open the other, to almost the end A. or the end C. and make the arch E F. Also set one foot in the end D. (of the line DH.) and with the same distance make the arch H I. That done, take the distance F E. and setting one foot in H. crosse the arch H I. in K. Lastly draw the line D K. which shall include the angle K D H. equall to the angle A B C. required. 23.1

Prob. VIII.

To deuide an Angle giuen into two equall partes.

Let ABC. bee an angle giuen ; to bee deuided into two equall parts.

Set one

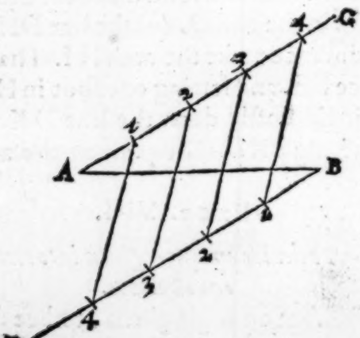


SEt one foot in B. and opening the other at pleasure, make in the sides, the points D. and E. Then with the same distance or some other, setting one foot
9.1 in E. make the arch F. that done, set one foot in D. and crosse that arch in G. Lastly drawe the line B G. which shall deuide the angle A B C. into two equall parts required.

Prob. IX.

To deuide a Line giuen into any number of equall parts required.

Let A B. bee a Line giuen, to bee deuided into fiue equall parts.



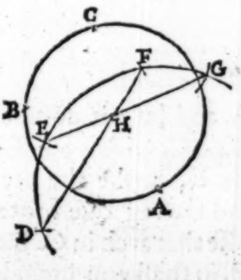
First

FIrst from the end A. drawe a line at pleasure, making with the giuen line AB. any kinde of angle, as the angle B A C. then by the seauenth Proposition make the angle D B A. equall thereunto by drawing the line BD. That done, set from A. towards C. foure equall spaces at pleasure, (alwaies one lesse then the number whereinto the line giuen is to be deuided) Likewise beginning at B. set vppon the line 9, 6.
BD. the same foure equall spaces from B. towards D. as you see on both sides, numbred by 1.2.3.4. Lastly, drawe crosse lines from one point to the other, to cut the line AB. so shall you deuide it into fiue equall parts required.

Prob. X.

To bring three points not lying in a straight line, into one circomference.

Let ABC. be three points giuen, to be brought into one Circomference.



SEt one foot in A. and opening your Compasses to aboue halfe the distance AB. make the arch DEFG,

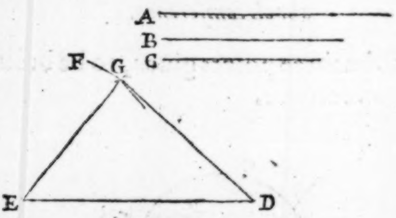
 Then

Then with the ſame diſtance, ſetting one foote in B. croſſe that arch in the points D F. and drawe the line D F. Then ſet alſo one foot in C. and with the ſame diſtance croſſe againe that arch in the points GE. and drawe alſo the line E G. which cutteth the line D F. in H. So is H, the Center: Therefore ſet one foot in H. and extend the other to any of the points ABC and make the Circle A B C. which ſhall paſſe by the three giuen points required.

PROB. XI.

Of three lines giuen, ſo the two ſhorteſt together be longer then the third, to make a Triangle.

Let A B, and C. bee three lines giuen, whereof it is required to make a Triangle.

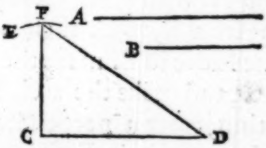


TAke the line A. and laye it downe from D, to E. Then take the line C. with your Compaſſes: and ſetting one foot in E, make the arch F. that done take the line B. and ſetting one foote in the end D. with the other croſſe that arch in G. Laſtly, drawe the
22.1. lines D G. and GE. ſo ſhall you include the Triangle DGE. whoſe three ſides ſhall be equall to the three lines A. B. C. required.

Prob. XII.

To make a right angled Triangle, the two containing sides being giuen.

Let A B. be the two Containing ſides, and it is required, to make a right angled Triangle.

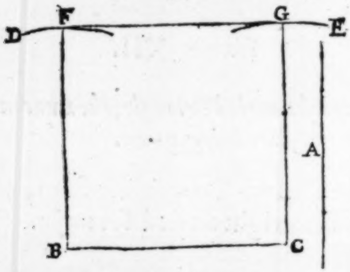


TAke with your Compaſſes, the line A. and laye that downe from C, to D. Then take alſo the line B. and ſetting one foot in the end C. with the other make the arch E. That done by the third propoſition vppon the end C. erect a perpendicular to cut the arch E, in F. Laſtly, drawe the line F D. ſo ſhall you include the right angled Triangle C D F. whoſe two containing ſides C D, and C F. are equall to the giuen lines A, & B. which was required. 31.3.

Prob. XIII.

To make a ſquare, the ſide being giuen.

Let A, be the ſide of a ſquare and it is required to make out the ſquare.

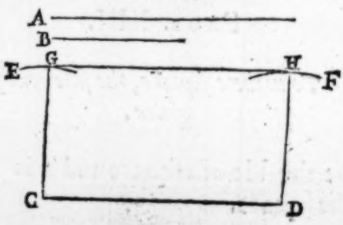


TAke the line A. with your Compaſſes, and laye that downe from B, to C. then with the diſtance B C: ſetting one foote in B. make the arch D. Set alſo one foot in C, and make the arch E. Then by the third Propoſition, erect a perpendicular vppon the end B, to cut the arch D, in F. That done, take the
46,1. diſtance BC, and ſetting one foote in F, with the other croſſe the arch E, in G. Laſtly, drawe the lines F G, and G C, ſo ſhall you include the Square BFGC, whoſe ſide ſhall be equall to the line A, required.

Prob. XIIII.

To make a Parralellograme or a long Square, the length and breadth being giuen.

Let A, and B, be the length and breadth giuen, and it is required to make the long ſquare.



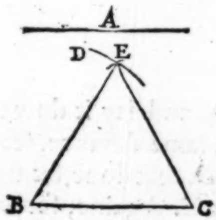
Take

TAke the length A, with your Compaſſes, and lay that downe from C, to D. Then take alſo the breadth B. and ſetting one foote in the end C, with the other make the arch E. the like doe at the end D. and make the arch F. Then by the third propoſition vppon the end C, erect a perpendicular, to cut the arch E, in G. That done, take the length C D, and ſetting one foot in G. with the other croſſe the arch F, in H. Laſtly, drawe the lines GH. and HD. ſo ſhall you include the long ſquare C G H D. whoſe length and breadth ſhall be equall to the lines A, and B, required. 3.1.3 3.1.1.

Prob. XV.

To make an Equilater triangle, the ſide being giuen.

Let A, be a line giuen, and it is required to make an Equilaterall triangle, whoſe ſide ſhall bee equall thereunto.



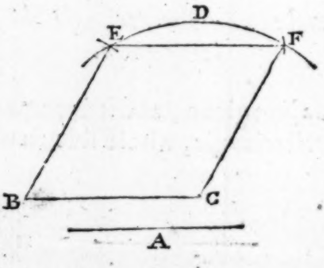
TAke the line A. and lay it downe from B. to C. Then with the ſame diſtance, ſetting one foot in B, with the other make the arch D. that done, ſet one

foot in C, and crosse the arch in E. Lastly, drawe the lines B E, and E C. so shall the Triangle B E C, be equilaterall, and his side equall to the giuen line A. which was required to be made.

Prob. XVI.

To make a Rombus the side being giuen.

Let A. be a line giuen, and it is required to make a Rombus, whose side shall be equall thereunto.

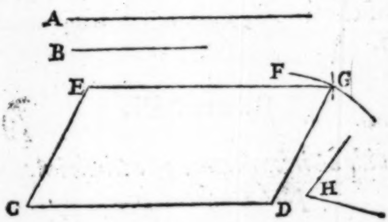


TAke the line A, and lay it downe from B, to C. then with the same distance, setting one foot in C. make the arch D. that done, set one foot in B, and crosse that arch in E. Againe, set one foot in E. and
1. 1. crosse the same arch againe in F. Lastly, drawe the lines B E. E F. and F C. so shall you inclose the Rombus B E F C. whose side shall be equall to the line A, required.

PROB. XVII.

To make a Romboides, the length and breadth being giuen.

Let A, and B. be the length and breadth giuen, and it is required to make the Romboides.



TAke the length A, and lay it downe from C, to D. Then take also the breadth B, and setting one foot in the end C, with the other, take any where a point as E. and drawe CE. then with the same distance setting one foot in the end D, with the other make the arch F. That done, take the whole length C D, 1. Pet.
and setting one foot in E, with the other crosse the 31.1
arch F, in G. Lastly, drawe the lines E G, and G D. so shall you include the Romboides C E G D, whose length and breadth shall be equall to the lines A, and B, required.

PROB. XVIII.

To make a Romboides the length, and breadth being giuen, whose two opposite angles shall be each equall to an angle giuen.

Let in the first Diagram A, and B. bee the length and

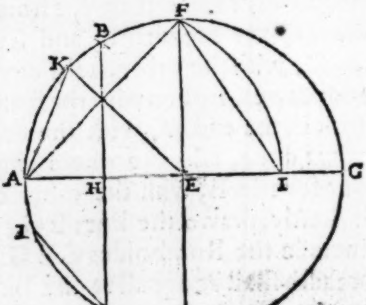
and breadth giuen, and let it be required to make a
23.1 Romboides whose length and breadth shall be equall
31.1. thereunto, and hauing two of his opposite angles, each equall to the angle H.

First laye downe the length from C, to D. Then by the seauenth proposition make the angle E C D. equall to the angle H. Yet drawe the line C E. but of the length of the line B, and then finish it as in the last proposition.

Prob: XIX.

To deuide a Circomference of a Circle into any part not aboue 10.

Let A B C D. bee a circle giuen to be so deuided.



First drawe the Diameter A E C, which deuides the Circomference into two equall parts. Then take the semi-diameter, and setting one foote in A. with the other foot make in the Circomference the points B and D.

B, and D. and drawe BD, which ſhall goe thriſe a-
bout the Circle. That done, by the firſt Propoſition 17.Difi.
deuide the Diameter AC. into two equall parts at 15.4.
right angles with FG. then drawe AF, which ſhall be 6.4.
$\frac{1}{4}$ part. That done, ſet one foot in H. (where the third 6.2.
part cutteth the Diameter AC.) and extend the other 47.1.
to F, and make the arch FI. then drawe the right line 9 } 13
FI. which ſhall be $\frac{1}{5}$ part. 10

The ſixt part is alwaies the Semi-diamiter.

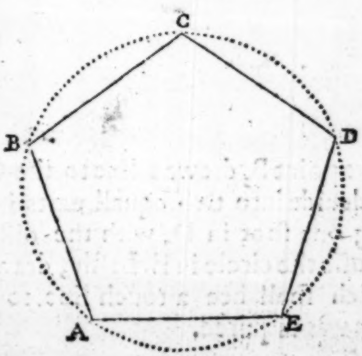
The $\frac{1}{7}$ part is halfe the third, viz. BH, or HD.
For the eight part, deuide by the eight propoſition the angle AEF, into two equall parts, with the line EK, which cutteth the lymbe in K. then drawe AK. which ſhall be the eight part.

For the ninth take alwaies $\frac{1}{3}$ of the arch BAD, as DL.

The tenth is alwaies the line EI.

Prob. XX.

To make a Poligon of fiue equall ſides and angles, otherwaies called a Pentagon.

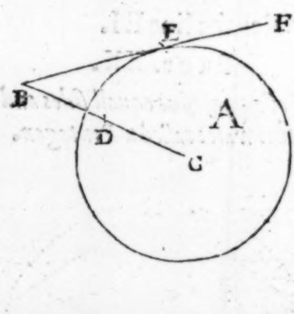


FIrst make an obscure Circle, then by the last Proposition finde the fift part, which set fiue times about in the lymbe, as you see by the letters ABCDE, and drawe lines from point to point, so shall you include a Pentagon, as ABCDE, which was required.

Prob. XXI.

From a point assigned, to drawe a touch line to a Circle giuen.

Let A, be a Circle giuen, and let it be required to drawe a touch line thereunto from the point B.

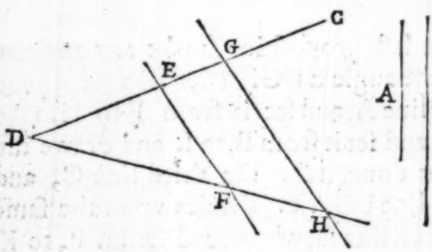


FRom the point B, drawe a line to the Center C, which deuide into two equall parts in D. Then keeping one foot in D, with the distance DB. or DC. crosse the circle in E. Lastly, drawe the line
17.3. BEF, which shall bee a touch line to the giuen Circle A. as was required.

PROB: XXII.

Vnto two lines giuen, to finde a third proportionall line.

Let A and B. be two lines giuen, and let it be required to finde a third line in proportion to them.



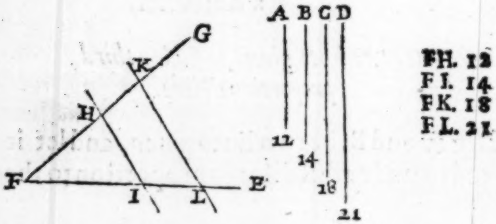
A. 4.	D E. 4.
B. 6.	D F. 6.
	D G. 6.
	D H. 9.

FIrst make any angle as C D H. then set the line A, from D. to E, and the line B. from D to F. and 11.6. also from D, to G. Then drawe E F. that done, by the point G. drawe a Parralell to E F. as G H. so shall D H, be the third proportionall line required.

PROB. XXIII.

Vnto three lines giuen, to finde a fourth in proportion, that is to performe the rule of three in lines.

Let, AB, and C. be three lines giuen, and it is required to finde a fourth proportionall line.



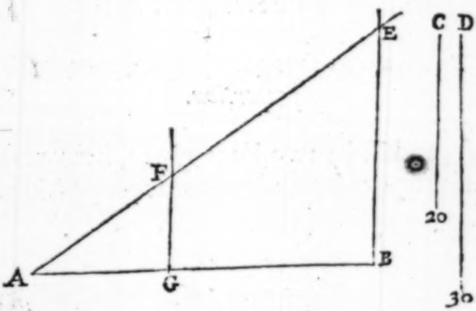
First as in the last proposition, make any angle at pleasure, as the angle E F G. Then take with your Compasses the line A, and set it from F to H. take also the line B, and set it from F, to I. and drawe the line H I. That done, take the third line C, and
12.6. set it vpon the line F G, viz. (alwaies vpon the same line where the first line A, was placed) from F, to K.
Then by K, drawe a Parralell to H I. as K L. to cut
by y^e 6^th Prop: F E, in L. so shall F L. be the fourth proportionall line required.

Prob. XXIIII.

To deuide a line giuen, into two parts, in proportion one to the other according to two lines giuen.

Let A B, be a line giuen, to be deuided into two such parts, that the lesser may be in proportion to the greater: as the line C, to the line D.

From



AF. 20.
FE. 30.
AG. 16.
GB. 24.

FRom the end A, drawe the line AE, making the angle B A E. then set the line C, from A, to F, and 10.6.
the line D, from F, to E. and drawe the line E B. Lastly, by the point F, drawe a Parralell to E B, as F G, to cut A B, in G. so shall A B, be deuided in G. as C, to D. which was required.

PROB. XXV.

To cut off from a line giuen, any part or parts required.

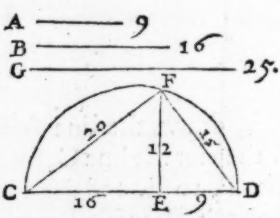
Let in the last Diagram, A B, be a line giuen, and let it be required to cut off from it $\frac{2}{5}$ parts.

FIrst from the end A, drawe the line AE, making any angle as B A E, then set on any fiue equall parts from A to E, and also two of the same parts from A, 9.6.
to F. That done, drawe the line E B. Then by F, draw a Parralell thereunto, to cut A B, in G. so shall A G, be the $\frac{2}{5}$ parts of A B, which was required.

Prob. XXVI.

Betweene two lines giuen, to finde a meane proportion.

Let A, and B. be two lines giuen, betweene the which it is required to finde a meane proportion.



Ioyne the lines A, and B, so together that they make one right line as C D, being ioyned together in the point E. and vppon the line C D, describe the Semicircle viz. C F D. Then vppon the point E, where the
13.6. lines A, and B. being ioyned together meet, erect a Perpendicular to cut the lymbe in F. as E F, which shall be a meane proportion betweene the lines A, and B, required.

Another way.

AGaine, in the same Diagram, let the lines A, and G, be giuen, betweene the which it is required to finde a meane proportion. Take the line G. and laye it downe from C, to D. and drawe C D. where-

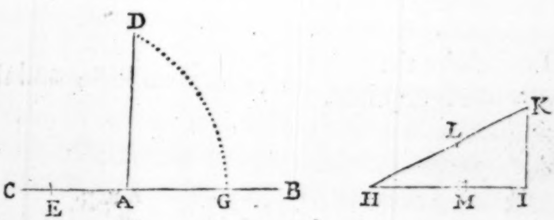
vpon

vpon describe the Semi-circle C F D. Then take the line A. and set it from D, to E. then vppon the point E. erect a perpendicular to cut the lymbe in F. Lastly, drawe D F. which shall be a meane proportion betweene D E, and D C. or betweene the lines A, and G, required: and if you drawe C F. it shall be a meane betweene B. and G. that is betweene C E, and C D. 31.3. 8.6 4.6.

Prob. XXVII.

To deuide a line giuen, by Extreame and meane proportion.

Let A B, be a line giuen to be deuided by extreame and meane.



A B. 10
A G. r. 125 — 5.

I H. 10.
I K. 5. H L. or H M. r. 125. — 5

INcrease A B. at length to C. Then vpon the point A. erect a Perpendicular as A D. of the length of A B. That done, take halfe A D. or A B. and set it from A. to E. then with the distance E D. make the arch D G. so shall A B. be deuided by extreame and meane proportion in G. and A G. is the greater segement, and G B the lesser. 11.2.

Another

Another way.

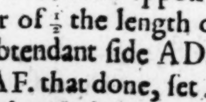
Againe, in the last Diagram let H I. be a line giuen, to be deuided by extreame and meane proportion.

11.2 VPon the end I. erect a perpendicular as I K. of the length of halfe the giuen line H I. then drawe the subtendant side H K. that done, set K I. from K. to L. Againe, set H L. from H. to M. so shall H I. be deuided by extreame and meane proportion in M. And H M. shall be the greater segement, and M I. the lesser.

Prob. XXVIII.

The greater segement of a line deuided by extreame and meane proportion being giuen, to finde the whole line.

Let B A. be the greater segement giuen, and the whole line is required.



AB. R.
125 -- 5
CB. 10

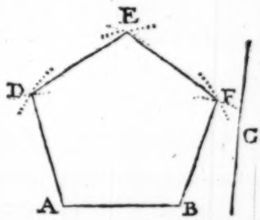
INcrease B A. to C. then vppon the end B. erect a perpendicular of ½ the length of AB. as B D. And drawe the subtendant side A D. From which substract D B. rest A F. that done, set A F. from A. to C.
2.Theo.13 so shall C B. be the whole line required.

Prob. XXIX.

Prob. XXIX.

Vpon a line giuen to describe a Pentagon.

Let AB. be a line giuen, whereupon a Pentagon is to be made.

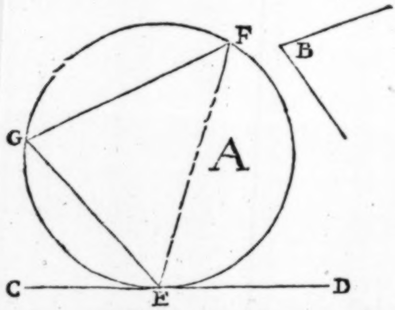


BY the last proposition, counting the side AB. to be the greater segement of a line deuided by extreame and meane proportion, finde the whole line, which let be the line C. Then with that distance setting one foot in B. make the arches D and E. Also set one foot in A. and make the arch F. That done, with the distance of the giuen side AB. setting one foot in A. 8.13. crosse the arch D in D. and setting one foote in B. crosse the arch F in F. also set one foot in F. and crosse the arch E in E. Lastly, drawe the lines AD, DE, EF, FB. so shall you include the Pentagon ADEFB. being made vpon the line AB. which was required.

PROB. XXX.

From a Circle giuen, to cut of a section, wherein may be placed an angle, equall to an angle giuen.

Let A. be a Circle giuen, from the which it is required, to cut off a ſection wherein may bee placed, an angle equall to the angle B.

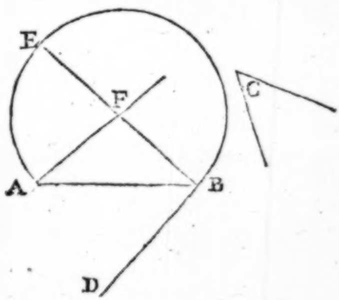


First drawe a touch line by the 21. propoſition as C D. which toucheth the circle in E. then vpon the point E. (by the ſeauenth propoſition) make the
34.3. angle D E F. equall to the angle B. by drawing the line E F. ſo ſhall the ſection E F G. Containe an angle equall to the angle B. required: for count E F. the baſe of ſome triangle, and then from the ends E and F. drawe lines to any point in the Circomference, as the lines E G. and F G. meeting in the point G. and then the angle G. ſhall bee equall to the angle B. as a foreſaid.

PROB. XXXI.

Vpon a line giuen, to describe such a section of a Circle, as may containe an angle, equall to an angle giuen.

Let A B, be a line giuen, and it is required thereon, to describe a section of a circle that may containe an angle, equall to the angle C.

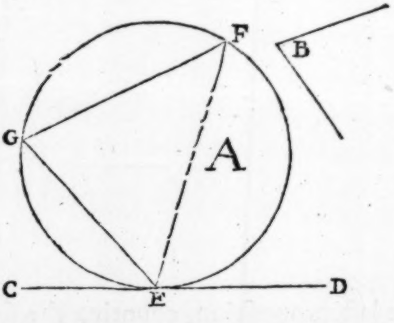


BY the seauenth proposition drawe the line BD. making the angle ABD. equall to C. the angle giuen. Then vpon the point B. erect a Perpendicular to DB, as BE. That done, make the angle F A B. equall to the Angle A B E. by drawing the line A F. 33.3. which cutteth BE in F. so shall F be the Center, therefore, set one foote in F. and extend the other to any of the ends A, or B. and make the arch A E B. which shall containe an angle equall to the angle C, required.

Prob. XXX.

From a Circle giuen, to cut of a section, wherein may be placed an angle, equall to an angle giuen.

Let A. be a Circle giuen, from the which it is required, to cut off a section wherein may bee placed, an angle equall to the angle B.

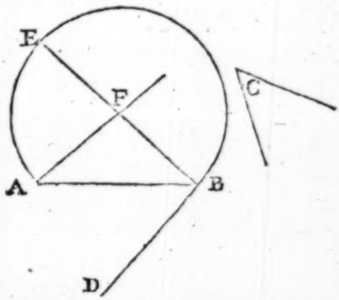


First drawe a touch line by the 21. proposition as C D. which toucheth the circle in E. then vpon the point E. (by the seauenth proposition) make the angle D E F. equall to the angle B. by drawing the line
34.3. E F. so shall the section E F G. Containe an angle equall to the angle B. required: for count E F. the base of some triangle, and then from the ends E and F. drawe lines to any point in the Circomference, as the lines E G. and F G. meeting in the point G. and then the angle G. shall bee equall to the angle B. as aforesaid.

Prob. XXXI.

Vpon a line giuen, to describe such a section of a Circle, as may containe an angle, equall to an angle giuen.

Let A B, be a line giuen, and it is required thereon, to describe a section of a circle that may containe an angle, equall to the angle C.

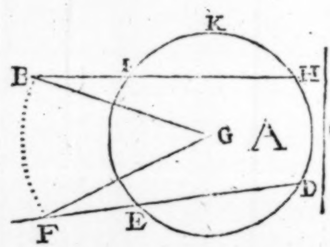


BY the seauenth proposition drawe the line BD. making the angle ABD. equall to C. the angle giuen. Then vpon the point B. erect a Perpendicular to DB, as BE. That done, make the angle F A B. equall to the Angle A B E. by drawing the line A F. 33.3. which cutteth BE in F. so shall F be the Center, therefore, set one foote in F. and extend the other to any of the ends A, or B. and make the arch A E B. which shall containe an angle equall to the angle C, required.

Prob. XXXII.

From a point assigned, to drawe a line to cut off an arch of a Circle, whose chorde shall be equall to a line giuen, the said Chorde being lesse then the Diameter of the Circle.

Let A, be a Circle giuen, and let B, be a point assigned, from whence it is required to drawe a line to cut off such an arch from the Circle, whose Chorde shall be equall to the line C.



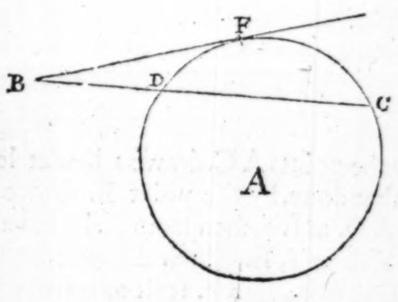
TAke with your Compasses the line C. and set it any where in the Circomference, viz, from D. to E. then drawe the line D E. at length to F. that done, from B. drawe a line to the Center G. then keeping one foot in G. with the other (at the distance GB) make the arch B F. to cut D E. being drawne forth in F. That done, take F D. and setting one foot in B. with the other crosse the Circle in H. Lastly, drawe the line B I H. which cutteth off the Arch I K H. whose Chord

Chord I H. is equall to C. the line giuen which was required.

Prob. XXXIII.

From a point without a Circle to drawe a line, cutting off an arch in such sort, that the Chorde of the arch cut off shall be a meane proportion, betweene the whole line drawne from the point to the further side of the Circomference, and the part of that line from the point to the neerest side of the Circomference: wherein is to be noted, that the point without, must be so placed, that a touch line drawne from it to the Circle, may not exceed the Diameter of the Circle.

Let A, be a Circle giuen, and let B: be a point assigned, from whence it is required, to drawe a line as B C. in such sort that C D. shall be a meane proportion betweene B D and B C.



FIrst, from the point B. drawe by the 21. proposition a touch line to the Circle, as B F. which toucheth in the point F. That done, count B F. 36.3.

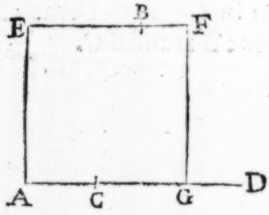
 the

the greater segement of a line deuided by extreame and meane proportion, and then by the 28. proposition finde the whole line, which take, and setting one foot in B. with the other crosse the Circle in C. Lastly, drawe the line BC. which performeth your desire.

Prob. XXXIIII.

To make a Geometricall square to passe by any three points giuen.

Let A B C. be three points giuen, and let it be required to make a square to passe by them.



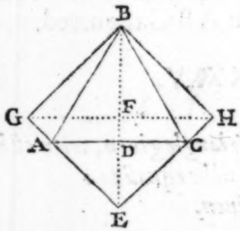
First by the points A C. drawe a line at length, as A D. that done, by the point B. drawe a Parralell to A D. as E F. then from A. let fall a Perpendicular to E F. as A E. which distance set vpon the Parralell E F. from E to F. set it also from A, to G.
31.1. and drawe FG. so shall you include the Square AEFG
12.1. which shall passe by the three points AB C. required.

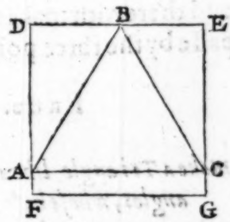
This is not so easie if the points giuen, make an equilaterall Triangle: wherefore I will shew you how it

it may then be done, (which is diuers waies) whereof I will set two of the best.

Another way.

Againe, let A B C, be three points giuen, by which a Geometricall Square is to passe.





FIrst drawe the lines A B. B C. and C A. inclosing the Equilaterall Triangle A B C. then from the point B. let fall a perpendicular as B D. which increase to E. so that D E. may be equall to D C. or D A. (the ½ of the side A C.) That done, deuide the whole line B E. into 33.3.
two equall parts at right angles in F. by the line G H. then set alwuies ½ BE. from F. to G. and to H. Lastly, drawe the lines BH. HE. EG. and GB so shall you include a square that shall passe by the points A B C, required.

Another way.

Againe, in the second figure of the last Diagram, on your right hand, let A B C. bee three points giuen,

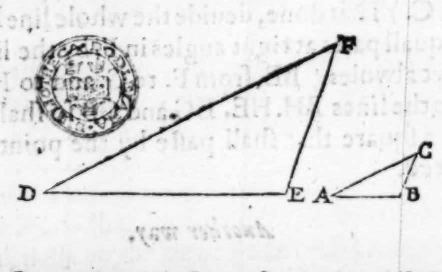
giuen, by which it is required to make passe a Geometricall square.

First, drawe lines from point to point, making the Triangle ABC. That done, by B. drawe a Parrallell to AC. as DE. Then from A. let fall a Perpendicular vpon the said DE, as AD. which increase downeward to F. then set the distance AC. from D. to F. and therewith make the square DE. GF. which shall passe by the three points ABC. required.

Prob. XXXV.

To make a Triangle, like a Triangle giuen, with all his angles, whose base shall be equall to a line giuen.

Let ABC. be a triangle giuen, and let DE, be a line giuen, Now it is required to make another triangle like the triangle ABC. whose base shall be equall to the line DE.



By the seauenth proposition from the end D. protract an angle equall to the angle A. as EDF. then from the end E. protract an angle equall to the angle

B. as

B. as DEF. which ſhall incloſe the triangle D E F. like A B C. vpon the baſe D E. which was required.

Prob. XXXVI.

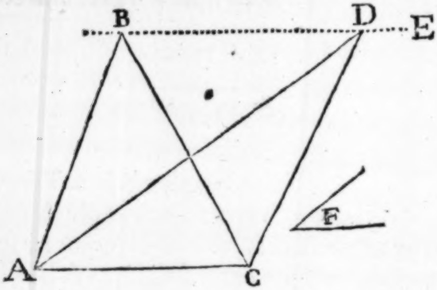
IN the Diagram following there is a Triangle as A B C. now there is drawne a line at pleaſure, as C D making the angle A C D, And it is required from A. to drawe a line to ſome part of C D. as A D. (in ſuch ſort) that the triangle A C D. may be equall to the giuen triangle A B C.

BY the point B. drawe a Parralell to the baſe A C. as B D. to cut C D. in D. Then drawe from the angle A. a line to the point D. (as A D) ſo ſhall you include the triangle A C D. equall to the triangle A B C. which was required.

Prob. XXXVII.

To reduce a Triangle into another Triangle, hauing the ſame baſe but other angles.

Let A B C. be a triangle giuen, and it is required to reduce the ſame into another triangle, hauing the ſame baſe but any other angles.



AC. 25.
Perp. from B. to AC. 28.
Perp. from D. to AC. also 28.

BY the second way of the 6. Proposition drawe from the point B. a Parralell to the base AC. as BDE. Then from A. the one end of the base, drawe a line to any point in that Parralell, as the line AD. (to the point D.) Lastly, from the other end C. drawe to the same point D. the line CD. so shall the triangle ACD. be equall to the triangle ABC. hauing the same base, viz. AC. but other angles which was required.

Prob. XXXVIII.

A Triangle being giuen, to make another equall thereunto vpon the same base, and hauing an angle equall to an angle giuen.

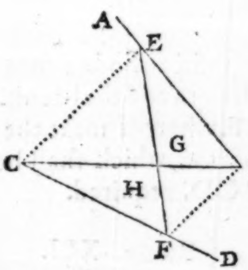
Let in the last Diagram, ABC, be a triangle giuen, and it is required to make another equall thereunto vpon the same base, but hauing one angle equall to the angle F.

First,

FIrst by the top B. drawe a Parralell to the base AC. by the second way of the sixt Proposition as B E. Then by the seauenth proposition from the point A. make the angle C A D, equall to the angle F. and drawe the line AD. till it touch the Parralell B E in D. Lastly, drawe the line C D. so shall you include the triangle A D C. equall to the triangle A B C. vpon the same base A C. hauing one angle (as C A D) equall to the angle F. required.

PROB. XXXIX.

Let A B. B C. and C D. be three lines giuen, making the two angles A B C. and B C D. and let E. be a point assigned, from whence it is required to drawe a line as E F. in such sort that the triangle G. may be equall to the triangle H.



FIrst from the point E. drawe an obscure line to C. as the pricked line E C. then by the 6. proposition from B. drawe a Parralell thereunto as B F. which cutteth

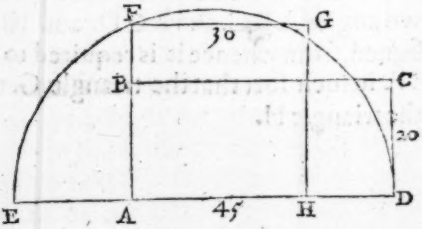
cutteth C D. in F. Laſtly, drawe the line E F. which performeth the deſire.

Theſe foure laſt Prob. haue their demonſtration out of the 37. 1. *of* Euclid.

Prob. XL.

To reduce a long ſquare into a Geometricall ſquare.

Let A B C D. be a long ſquare giuen, to be reduced into a Geometricall ſquare.



BY the *26.* propoſition finde a meane proportion, between the length and the breadth, which meane proportion is A F. whereof make the ſqu are AFGH. by the 13. propoſition, which ſhall be equall to the long ſquare A B C D. required.

Prob. XLI.

To reduce a Rombus into a Square.

FRom one of the obtuſe angles, let fall a Perpendicular, to the baſe. Then finde a meane proportion betweene

betweene that perpendicular and the base, and that shall be the side of a square equall thereunto.

PROB. XLII.

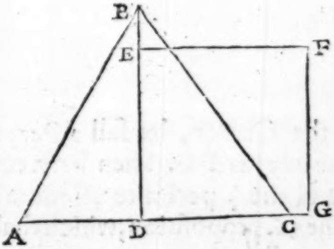
To reduce a Romboides into a Square.

FRom one of the obtuse angles, let fall a perpendicular vpon the base (which must be one of the longest sides) Then betweene that perpendicular and the said base, finde a meane proportion, which shall be the side of a square equall thereunto.

PROB. XLIII.

To reduce a Triangle into a Square.

Let A B C. be a triangle giuen, to be reduced into a square.



FIrst from the angle B. let fall a perpendicular to the base A C. as B D. Then by the 26. proposition finde

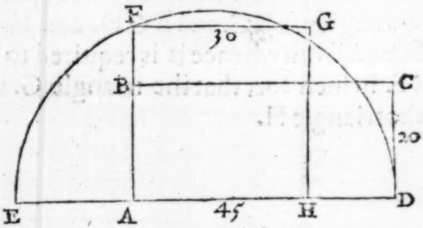
cutteth C D. in F. Laſtly, drawe the line E F. which performeth the deſire.

Theſe foure laſt Prob. haue their demonſtration out of the 37. 1. of Euclid.

Prob. XL.

To reduce a long ſquare into a Geometricall ſquare.

Let A B C D. be a long ſquare giuen, to be reduced into a Geometricall ſquare.



BY the *26.* propoſition finde a meane proportion, between the length and the breadth, which meane proportion is A F. whereof make the ſqu are AFGH. by the 13. propoſition, which ſhall be equall to the long ſquare AB C D. required.

Prob. XLI.

To reduce a Rombus into a Square.

FRom one of the obtuſe angles, let fall a Perpendicular, to the baſe. Then finde a meane proportion betweene

betweene that perpendicular and the baſe, and that ſhall be the ſide of a ſquare equall thereunto.

PROB. XLII.

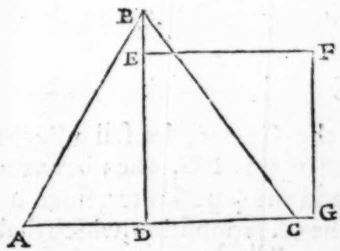
To reduce a Romboides into a Square.

FRom one of the obtuſe angles, let fall a perpendicular vpon the baſe (which muſt be one of the longeſt ſides) Then betweene that perpendicular and the ſaid baſe, finde a meane proportion, which ſhall be the ſide of a ſquare equall thereunto.

PROB. XLIII.

To reduce a Triangle into a Square.

Let A B C. be a triangle giuen, to be reduced into a ſquare.



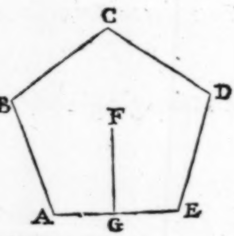
FIrſt from the angle B. let fall a perpendicular to the baſe A C. as B D. Then by the 26. propoſition

finde a meane proportion betweene the said Perpendicular and the halfe base, which will be D E. whereof make the square D E F G. which shall be eqaall to the triangle required.

Prob. XLIIII.

To reduce a Poligon consisting of equall sides and angles into a Square.

Let A B C D E. be a Poligon giuen, of fiue equall sides and angles (more properly called a Pentagon) to be reduced into a square.



FIrst from the Center, let fall a Perpendicular to one of the sides as F G. Then betweene that Perpendicular and the $\frac{1}{2}$ perimiter, finde a meane proportion by the 26. proposition, which shall be the side of a square equall thereunto.

These fiue last Prob. haue their demonstrvtion out of the 14. *of the* 2. *of Euclid.*

Prob. XLV.

Prob. XLV.

From a point in any side increased of a Triangle giuen, to drawe a line to the opposite side, through the side next the point, to include a Triangle equall to the Triangle giuen.

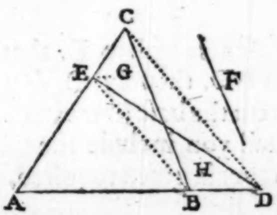
Let in the Diagram following A B C. be a triangle giuen, whose base A B. runneth forth to D. Now it is required from D. to drawe a line to some part of the side A C. in such sort that so much as it cutteth off so much it may take in.

FRom the point D. to C. drawe an obscure line as D C. then by B. drawe a Parralell thereunto, to cut A C. in E. Lastly, drawe D E. which shall cut off the triangle G. and take in the triangle H. equall thereunto.

Prob. XLVI.

A Triangle being giuen, to make another equall thereunto, whose base or Perpendicular, is limmited.

Let A B C, be a triangle giuen, and it is required to make another equall thereunto, whose perpendicular shall be equall to the line F.

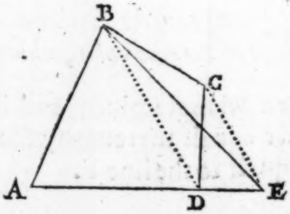


AT the distance of the line F. drawe a Parralell to the base AD. which cutteth the side AC. in E. Then increase the base AB. at length to D. That done, drawe EB. then by the point C. drawe a parralell thereunto as CD. to cut the base being increast in D. Lastly, drawe ED. so shall you include the triangle AED. equall to ACB. (for there is cut off the triangle G. and taken in the triangle H. equall thereunto.

Prob. XLVII.

To reduce a Trapezia into a triangle

Let ABCD. be a Trapezia giuen, to be reduced into a Triangle.

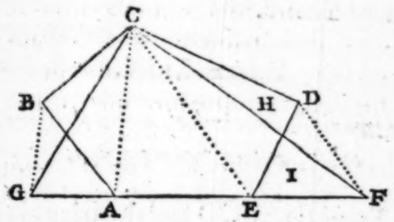


INcrease the base at length to E. that done, drawe the Diagonall BD. then by C. drawe a Parralell thereunto, to cut the base (increased) in E. Lastly, drawe BE. so shall you include the triangle ABE. equall to the Trapezia giuen required.

Prob. XLVIII.

From an angle in a plot giuen, to drawe a line to the base, increased (if so it require) that shall take in so-much as it cuts off.

Let ABCDE. be a plot giuen, and it is required to drawe a line from the angle C. in such sort, that the triangle H. cut off, be equall to the triangle I. taken in.



FIrst increase the base that way as the line from C. is to be drawne, viz. to F. Then drawe the obscure line C E. that done, from the point D. drawe a Parralell thereunto, to cut the base (being increased) in F. Lastly, drawe C F. which performeth the demaund.

Againe, let it be required from C. to drawe a line towards the left hand, as CG. in such sort, that so much as is cut off may be taken in. Increase the base E A. to G. then drawe C A. that done, by the point B. drawe a Parralell thereunto as B G. to cut E A. (increased) in G. Lastly, drawe the line C G. which shall take in so much as it shall cut off.

Note. Heereby may be gathered, how to reduce a plot into a triangle, with lines drawne from an angle assigned: for let the base be first increased both waies, Then drawe C F. as before taught, cutting off the triangle H. and taking in the triangle I. equall therunto, (so is there nothing lost) For the Trapezia ABCF. is equall to the plot ABCDE. Againe, (by the same rule) let CG. be drawne, taking in so much as it cutteth off, so shall the triangle C G F, be equall to the Trapezia A B C F. or vnto the plot A B C D E. required.

These 4. last Prob. haue their demonstration out of the 37. *of the* 1. *of* Euclid.

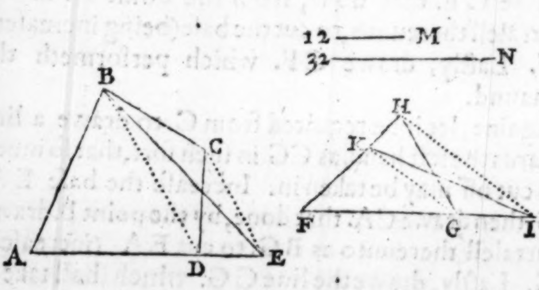
PROB. XLIX.

To giue two right lines in such proportion, one to the other, as two figures giuen.

Let the Trapezia ABCD. and the triangle F G H. be two figures giuen, and it is required to giue two right lines in proportion as the triangle to the Trapezia.

FI. 45. p. 12
FG. 30. p. 18

AE. 45.
Per. from B.
32.



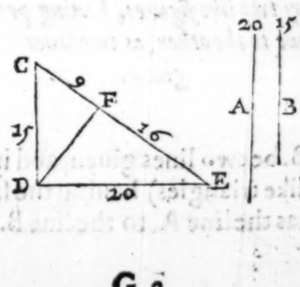
By

BY the 47. probleme bring the Trapezia into the triangle ABE. Then increase the base of the triangle F G. to I. till it be of the length of AE.(the base to the rtiangle ABE) Then by the 46. probleme, bring the triangle FGH. into the triangle FKI. Whose base FI is equall to A E. (the base to A B E.) That done, take the perpendicular or shortest distance of the triangle FKI. from K. on the base FI. which is the line M. 37.1.
Likewise, the perpendicular or shortest distance (in 1.6.
the triangle A B E) from B. to the base A E. which is the line N. so shall the line M. haue the same proportion to the line N. as the triangle F G H. to the Trapezia, ABCD. which was required.

Prob. L.

To giue two right lines, hauing such proportion one to the other, as two squares giuen.

Let A. and B. be the sides of two squares giuen, and it is required to giue two right lines, hauing the same proportion one to the other, as the square made of the line A, hath to the square made of the line B.



IOyne the lines A and B. ſo together, that they make a right angle, as C D E. and drawe the ſubtendant ſide C E, Then from the right angle D. let fall a
8. *6.* perpendicular to C E. (as D F) which deuideth C E
4. *6.* into two parts in F. which partes C F and E F. are
Cor. 19. *6.* two right lines in proportion one to the other, as the ſquare of A. to the ſquare of B. For as C F. to E F. ſo the ſquare of A. to the ſquare of B. which was required.

And not only 2. right lines may this way be giuen, hauing proportion together as 2. ſquares, but as 2. Circles, triangles, or other figures, whoſe angles are alike, and ſides proportionall, as if A. and B. were the Diameters of 2. Circles, then the lines C F. and E F. haue the ſame proportion one to the other as thoſe Circles.

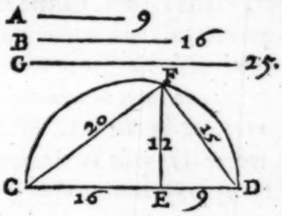
Againe, let A. and B. be 2. ſides of 2. equiangled triangles, Then their Contents are as C F. to E F. and the like of 2. *Pentagons, Hexagons, Heptagons, &c.*

PROB. LI.

To make any two like figures, hauing proportion one to the other, as two lines giuen.

Let A. and B. be two lines giuen, and it is required, to make (two like triangles) hauing the ſame proportion together, as the line A. to the line B.

Ioyne



IOyne the lines A. and B. so together that they make one line as CD. whereupon describe the semi-circle, CFD. Then vpon the point E. where the lines are ioyned together, erect a perpendicular to cut the lymbe in F. as E F. Lastly, drawe the lines DF and CF. which shall be the sides of the triangles required. For an equilaterall triangle, made of the line DF. shall haue the same proportion, to an equilaterall triangle made of the line CF. as the line A. to the line B. which was required. Cor, 19.6 8.6. 4.6.

Or thus.

Againe, in the same Diagram, let A. and G. be two lines giuen, and it is required to giue the sides of two equilaterall triangles, which shall haue the same proportion together as the line A. to the line G.

FIrst, lay downe the line G. from C. to D. whereupon describe the semi-circle CFD. Then take the line A. and set it from D. to E. and vpon the point E. erect a perpendicular to cut the lymbe in F. Lastly, drawe DF. so shall DF. and DC. be the sides of two Equilaterall triangles, hauing the same proportion

one to the other, as the line A. to the line G. For as A to G. so an Equilaterall triangle made of the line DF. to an Equilaterall triangle made of the line DC.

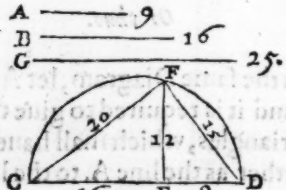
And in the same manner may you doe for Squares, Circles, or other like figures, as by the 91. Probleme doth more plainely appeare, where is taught how to increase or decrease a plot according to any proportion giuen.

But if your triangles to be made, bee not Equilaterall, Then, must you doe the like for euery of the sides apart, or els, by the rule of proportion, (hauing thus found one of their like sides) finde the rest, &c.

Prob. LII.

To deuide a line in power according to any proportion giuen.

Let CD. be a line giuen, to be deuided in power as A. to B.



BY the 24. probleme deuide CD. in E. as A. to B. viz. that as A. to B. so the lesser part DE. to the greater part EC. That done, describe vpon the line CD. the semi-circle CFD. then vpon the point

E. erect

E. erect a perpendicular to cut the lymbe in F. Lastly, 31.3.
drawe the lines D F. and C F. which together in po- 47.1.
wer shall be equall to the power of the giuen line CD, 8.6.
and yet in power one to another, as A. to B. which 4.6.
was required. 2 Car. 20.6

Prob. LIII.

To inlarge a line in power according to any proportion assigned.

Let (in the last Diagram) CE. be a line giuen, to be inlarged in power as B. to G.

BY the 23. probleme, say if B. giue G. what C E? answere CD. whereupon describe the semi-circle C F D. that done, vpon the point E. erect a Perpendicular to cut the lymbe in F. Lastly, drawe C F. which shall be in power to C E. as G. to B. which was required.

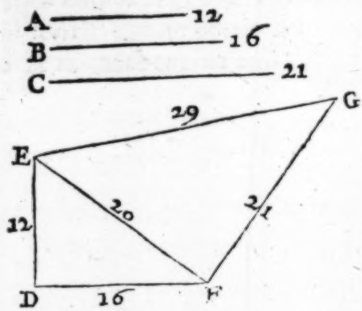
The demonstration heereof may be gathered from the places of Euclid *set downe by the last Probleme.*

Prob. LIIII.

To adde 2. 3. or more Squares together in one.

Let A B. and C. be the sides of three squares giuen, and it is required to adde them altogether in one, that is to finde the side of one square, which shall be equall to them all.

Of



OF the two ſides A. and B. make a right angle as the angle EDF. then drawe the ſubtendant ſide E F. which ſhall be the ſide of a ſquare equall to both the ſquares made of the lines A. and B. together. That done, vpon the end F. (of the line EF)
47.1. erect a perpendicular of the length of the line C. as FG. Then drawe EG. which ſhall be the ſide of a ſquare equall to three ſquares whoſe ſides are the lines A.B.C. required.

And in the ſame manner may you adde Circles, like Triangles, and other like figures together, as appeareth by the 31. Prop. of the 6. of Euclid.

Prob. LV.

To ſubſtract one ſquare from another.

In the laſt Diagram, let it be required to ſubſtract the

the ſquare of the line A. from the ſquare of the lineC.

FIrſt make a right angle at pleaſure (as the angle E DF.) then ſet the line A. from D. to E. that done take the line C. with your Compaſſes, and ſetting one foot in F. with the other croſſe the line DE. in 47,1. E. ſo ſhall DE. be the ſide of a ſquare remaining, when the ſquare of A. is taken from the ſquare of C. which was required.

PROB. LVI.

Within a Circle giuen, to inſcribe a Square.

Let in the Diagram following A B C D. be a circle giuen, wherein a ſquare is to be inſcribed, &c.

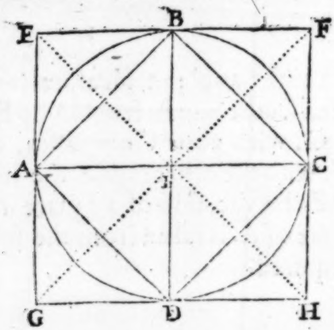
DRawe through the Center the Diameter A C. which croſſe at right angles, with BD. then drawe the lines A B. B C. C D. and D A. ſo ſhall 6.4. you inſcribe a ſquare within a Circle, which was required.

PROB. LVII.

About a Circle giuen, to deſcribe a ſquare.

Let A B C D. be a Circle giuen, about the which it is required, to deſcribe a ſquare.

H First,



FIrst drawe the two Diameters A C. and B D. crossing one another at right angles, which cut the Circle in the points A B C D. then by the points
7.4. B. and D. drawe Parralells to A C. also, by A. and C. parralells to B D. which foure lines meeting in the points E F G H. shall make the square required.

PROB. LVIII.

To inscribe a Circle within a Square.

Let in the same Diagram, E F H G. bee a square giuen, and it is required to inscribe a Circle within it.

DRawe the Diagonals E H. and F G. which cut one the other in I. which is the Center, From whence
8.4. let fall a perpendicular to one of the sides of the square, as I D. with which distance setting one foote

in

in the Center, make the circle ABCD. which shall stand within the square giuen EFHG. as was required.

Prob. LIX

To circomscribe a Circle about a square.

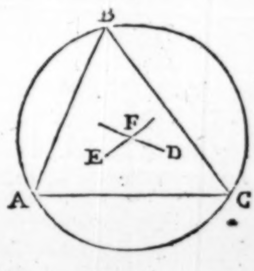
Let in the 57. Probleme ABCD. be a square giuen, about which a Circle is to be made.

DRawe the Diagonnals AC. & BD. which cut one another in I. which shall be the Center. Therefore set one foot in I. and extend the other to 9.4. any of the points A.B.C.D. and make the Circle ABCD. which shall compasse the ginen square required.

Prob. LX.

About a Triangle, to describe a Circle.

Let ABC. be a Triangle giuen, about the which is is required to make a Circle.



 Suppose

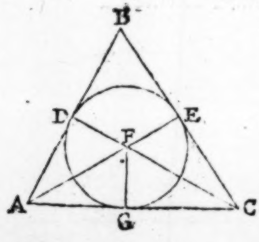
SVppose the 3. corners A.B.C. to bee 3. points giuen, then by the 10. probleme being those 3. points into one Circomference, so shall you make the Circle A.B.C. to include the triangle required.

Or (which is all one) deuide any 2. sides of the triangle into 2. equall parts at right angles by the first
5.4. probleme, as the side A B. with the line D. and B C. with the line E.(if they were drawne forth.) Which 2. lines meet in the point F. which shall be the Center, then set one foot in F. and extend the other to any of the angles A B C. and make the circle A B C. which shall include the triangle A B C, required.

Prob. LXI.

Within a Triangle giuen, to inscribe a Circle.

Let A B C. be a triangle giuen, wherein a circle is to be inscribed.



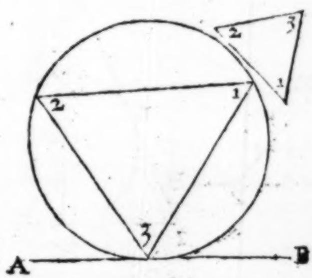
By

BY the eight Probleme deuide any two of the angles into two equall parts, as the angle A C B. with the line C D. and the angle B A C. with the line A E. which two lines meet in F. so is F. the Center, from whence let fall a perpendicular to any of the sides (as F G) vpon the side A C. with which distance make the circle D E G. vpon the Center F. which shall stand within the giuen triangle A B C. required. 4.4.

Prob. LXII.

To inscribe within a Circle, a Triangle, whose sides shall be in proportion one to the other, as the side of a Triangle giuen.

Let 1. 2. 3. be a circle giuen, wherein it is required to inscribe a triangle, whose sides shall haue proportion together as the sides of the little triangle 1. 2. 3. &c.



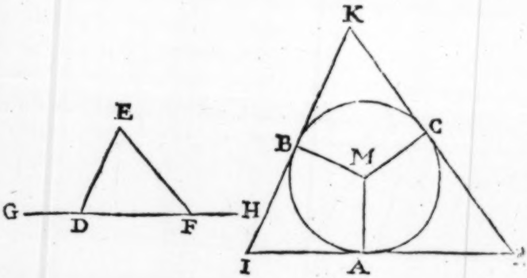
DRawe by the 21. Probleme a touch line, as A. 3. B which toucheth the circle in the point 3. Then make the angle A. 3. 2. equall to the angle 1. of

the little triangle, and the angle 1. 3. B. equall to the angle 2. of the same little triangle by the 7. Probleme. Lastly, drawe in the circle the line 2. 1. so shall you inscribe the triangle 1. 2. 3, within the circle, whose
2. 4. sides shall be in proportion one to the other, as the sides of the lesser triangle 1. 2. 3. which was required.

PROB. LXIII.

About a Circle giuen, to discribe a triangle, whose sides shall haue proportion one to the other, as the sides of a triangle giuen.

Let A B C. be a circle giuen, about the which it is required to describe a triangle, whose sides shall be in proportion one to another, as the sides of the triangle D E F.

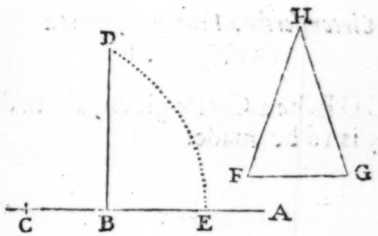


INcrease the base D E. on both sides, to G. and to H. making the angles E D G. and E F H. That done, from M. the center of the circle, drawe a line to any part of the circomference, (as M A.) Then make

the angle A M B. equall to the angle E D G. alſo, the angle A M C. equall to the angle E F H. That done, vpon the points A. B. C. erect perpendiculars, which will meet in the points K. L. I. ſo ſhall the ſides of the triangle K L I. haue proportion together, as the ſides of the giuen triangle D E F. which was required. 3.4.

Prob. LXIIII.

To make ſuch an Iſoſceles Triangle, that ſhall haue each angle at the baſe, double to that at the toppe.



BY the 27. propoſition deuide any line, by etxream and meane proportion, as the line A B. in E. ſo is B E. the greater ſegement. Then make an *Iſoſceles* triangle, whoſe baſe let be the ſaid greater ſegement, and the other ſides, each the whole line A B. as F G H. which ſhall be the triangle required. 10.4.

Prob. LXV.

PROB. LXV.

Within a Circle giuen, to inſcribe a Pentagon.

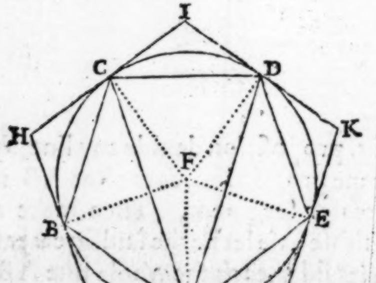
Let in the Diagram following ABCDE. bee a circle giuen, wherein a pentagon, is to be inſcribed.

BY the laſt Probleme make ſuch an *Iſoſceles* triangle as was there taught, hauing each angle at the baſe, double to that of the toppe. Then by the 62. Pro-
11.4. bleme inſcribe within the circle giuen a triangle, like that, as the triangle ACD. whoſe baſe CD. ſet fiue times in the lymbe, ſo ſhall you include the Pentagon ABCDE. within the circle which was required.

PROB. LXVI.

To Circomſcribe a Pentagon, about a Circle giuen.

Let ABCDE. be a Circle giuen, about the which a Pentagon, is to be made:



First

FIrst, inſcribe the Pentagon, A B C D E. as before taught, then from the center F, drawe lines to euery of the points A. B. C. D. E. That done, vpon euery of thoſe lines, on the points A B C D E. erect perpendiculars, which will meet in the points G H I K L. which ſhall include a Pentagon, about the circle which was required. 12.4.

Prob. LXVII.

Within a Pentagon giuen, to inſcribe a Circle.

Let in the laſt Diagram G H I K L. be a Pentagon giuen, within the which a circle is to be inſcribed.

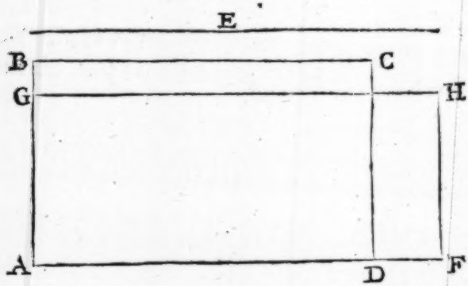
DEuide any two of the ſides in the mydſt, at right angles, as the ſide I K. with the line D F. and the ſide G L. with the line A F. which meet in F. ſo is F. the center. Then ſetting one foot in F. extend the other to one of the points A. or D. and make the circle A B C D E. which ſhall ſtand within the Pentagon G H I K L. required. 13.4.

Prob. LXVIII.

To reduce a long ſquare into another long ſquare whoſe length or breadth is limmited.

Let A B C D. be a long ſquare giuen, to be redu-

ced into another long ſquare, whoſe length ſhall be equall to the line E.



E. 48.
AB. 24.
BC. 40.
FH. 20.

INcreaſe A D. to F. then ſet the line E. from A. to F. That done, by the 23 Probleme, ſay if E. giue the length B C. what the breadth AB. anſwere A G. for the breadth (of the long ſquare to be made) and A F. or E. is the length, whereof make the long ſquare A G H F. which ſhall be equall to the long ſquare A C. and yet his length A F. equall to the giuen line E. which was required.

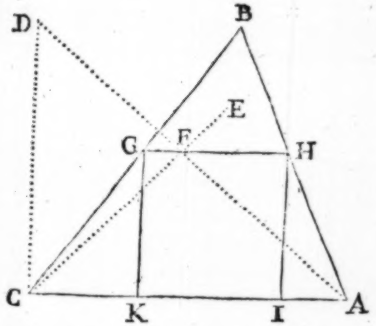
P. 23.

Prob. LXIX.

Within a Triangle, to inſcribe a Square.

Let A B C. be a triangle giuen, wherein a ſquare is to be inſcribed.

Vpon



AB.169.
AC.182.
CB 195.
GH.84.

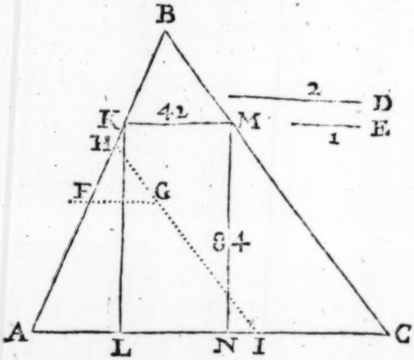
VPon the end C. erect a prerpendicular of the length of the perpendicular, from B. vpon the base A C. (as C D) then drawe the subtendant side A D. That done, deuide the right angle A C D. 32. 1.
into two equall parts (by the 8. Probleme) with the line 6. 1.
C E. which cutteth A D. in F. Lastly, by the point F. 12. 6.
drawe a Parralell to the base A C. as G H. whereof make the square G H I K. which shall stand within the triangle A B C. required.

Prob. LXX.

Within a Triangle, to inscribe a Parralellogram, whose sides shall haue proportion together, as two lines giuen.

Let A B C. be a triangle giuen, and let it be required to inscribe within it a long square, whose length shall haue proportion to his breadth as the line D. to the line E.

AB. 130.
AC. 140.
CB. 150.
BM 45.

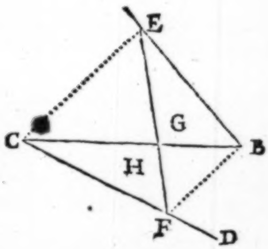


AT the distance of the length D drawe a Parralell to the base A C, as F G. to cut the side A B. in F. then set the breadth E. on the parralell from F. to G. and by G. drawe a parralell to the side B C. as H I. to cut A B. in H. Then say by the 23. Probleme, if
4.6. A H. giue A F. what A B? answere A K. from which
12.6. point K. let fall a perpendicular to the base A C. as K L. also, from K. drawe a parralell to A C. as K M. to cut the side B C. in M. Lastly, from M. let fall a perpendicular to A C. as M N. so shall you include the long square L K M N. within the triangle A B C. whose length shall be to his breadth as the giuen lines D. to E. which was required.

PROB. LXXI.

There is an angle B C D. and from a point as F. in the line C D. is drawne a line by chance of any length as F E. cutting off from the angle B C D. the triangle H. Now it is required from B. to drawe a line

line to ſome part of FE. as the line BE. to incloſe a triangle as G. equall to the triangle H. cut off.



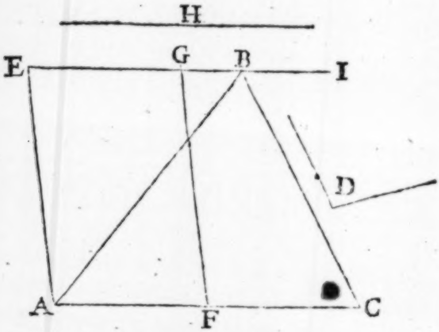
BF. 16 the parralels diſtance 25

DRawe from the end B. to the point F. a blinde line as B F. then from C. drawe a parralell thereunto as C E. to cut the line FE. in E. Laſtly, drawe the line BE. ſo ſhall you incloſe the triangle G. equall to the triangle H. cut off, which was required. 37.1.

PROB. LXXII.

To make a Romboides equall to a Triangle giuen, hauing two oppoſite angles each equall to an angle giuen.

Let AB C. be a triangle giuen, and it is required to reduce the ſame into a Romboides, hauing two oppoſite angles each equall to the ang le D.



A C. 36.
p. frō B. 28
A F. 18.
p. frō G. 28

FIrst, by the point B. drawe a parralell to the base A C. as E B I. then from the end A. protract an angle equall to the giuen angle D. as C A E. and drawe A E. till it touch that parralell in E. that done, take $\frac{1}{2}$ the base A C. which is A F. and set it in the
42.1. same Parralell from E. to G. Lastly, drawe F G. so shall you inclose the Romboides A E G F. equall to the triangle A B C. and hauing two opposite angles E. and F. each equall to the angle D. which was required.

Prob. LXXIII.

To reduce a Romboides into a Triangle.

Let in the last Diagram, A E G F. be a Romboides giuen, to be reduced into a triangle.

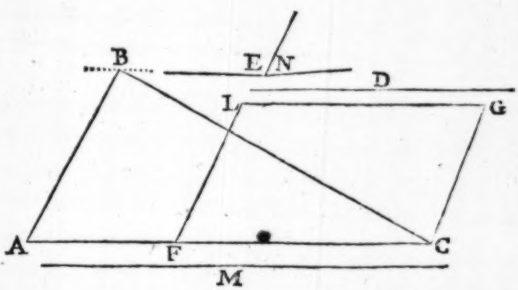
First,

FIrst increaſe the ſides E G. and A F. to I. and to C. then ſet A F the breadth of the Romboides from F. to C. ſo that A C. may be twiſe A F. that done, take in the line E I. any point at pleaſure, as the point 41. 1. B. from whence drawe the lines B A. and B C. ſo ſhall you include the triangle A B C. equall to the Romboides A E G F. required.

Prob. LXXIIII.

To make a Romboides, whoſe length is limmited, equall to a Triangle giuen, and alſo, hauing two oppoſite angles each equall to an angle giuen,

Let A B C. be a triangle giuen, and let it be required to make a Romboides equall thereunto, whoſe length ſhall be as long as the line D. and hauing two oppoſite angles, each equall to the angle E.



A C, 48. p ſrō. B. 20. C F. 30. p ſrō L. 16 D. 30. M. 48.

FIrſt, take the length D. and ſet it from C. to F. then from C. protract an angle equall to the angle E. as F C G. that done, ſay by the 23. Probleme if the line

line D. giue the perpendicular from B. to A C. what ½ the base A C. answere a line, at which distance draw a parralell to A C. as G L. (of the length of C F.)
P. 7. Lastly, drawe F L. so shall you include the Romboi-
P. 1. des C G L F. whose length C F. shall be equall to the
P. 23. giuen line D. and his opposite angles C. and L. each
P. 5. equall to the angle E. which was required.

Prob. LXXV.

A Romboides being made by chance, it is required to make a triangle equall thereunto, whose base shall be equall to a line giuen, and hauing an angle equall to an angle giuen.

Let in the last Diagram, the Romboides C F L G. be giuen, and it is required to make a triangle equall thereunto, whose base shall be of the length of the line M. and hauing one angle equall to the angle N.

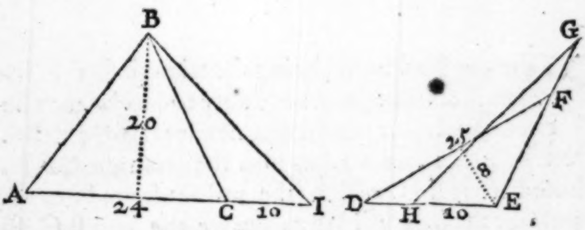
First increase the side C F. to A. then set the line M. from C. to A. for the base, that done, from A. protract an angle equall to the angle N. as the angle B A C. by drawing the line A B. Then say by the
P. 7. 23. Probleme, if the ½ base giue the perpendicular (of
P. 23. the Romboides) from L. vpon the side C F. what the length C F? answere a line, at the distance whereof, drawe a parralell to the base A C. as the pricked line B. to cut A B. in B. Lastly, drawe the line B C. so shall you include the triangle A B C. equall to the Romboides C F L G. and hauing an angle as the angle B A C. equall to the giuen angle N. which was required

Prob. LXXVI.

Prob. LXXVI.

To adde two seuerall Triangles together, and to make one of them both, whose perpendicular shall be equall to the perpendicular of one of the giuen Triangles.

Let A B C. and D E F. be two triangles giuen, and it is required to make one equall to them both, whose perpendicular shall be the perpendicular of the triangle A B C.



BY the 46. Probleme, reduce the triangle D E F. into another triangle whose perpendicular may be equall to the perpendicular of the triangle A B C. (as into the triangle G E H.) that done, increase the base of the triangle A B C, viz. A C. to I. 38.1. then take E H. the base of the triangle G E H. and set it from C. to I. Lastly, drawe the line, B I. so shall you include the triangle A B I. which shall be equall to both the triangles A B C. and D E F. together, and hauing the perpendicular of the triangle A B C. which was required.

37.1.
1.6.

Prob. LXXVII.

To substract one Triangle from another, and to make the Triangle left, to haue the perpendicular of one of the giuen Triangles.

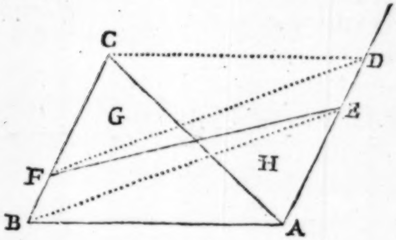
Let in the last Diagram A B I. and D E F, be two
38.1. triangles giuen, and it is required to substract the tri-
37.1. angle D E F. from the triangle A B I. and to make the
1.6. triangle left, to haue the perpendicular of the triangle A B I.

BY the 46. Probleme, being the triangle D E F. into another triangle, whose perpendicular may be equall to the perpendicular of the triangle A B I. (from B. on his base A I.) as into the triangle G E H. whose base is E H. which take and set from I. to C. (vpon the the base A I) then drawe the line B C. so shall remaine the triangle A B C. hauing the perpendicular of the giuen triangle A B I. which was required.

Prob. LXXVIII.

There is a triangle as A B C. and from A is drawne a right line as A E D. Now from the point E. in that line, it is required to drawe a line through A C. (as E F) in such sort that the triangle G. cut off, be equall to the triangle H. taken in.

First

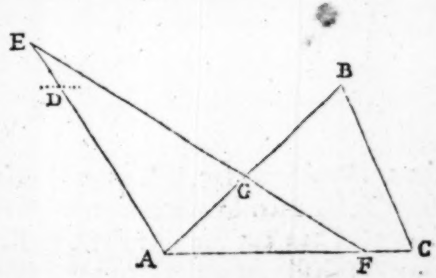


AB. 30.
p ſrō. C. 20
. ſrō D. 20

FIrſt by C. drawe a Parralell to the baſe A B. (as CD) to cut the line A E D. in D. that done, drawe the pricked line B E. then from the point D. draw a parralell thereunto to cut the ſide C B. in F. Laſtly, drawe the line F E. which performeth the demaund. 37. I.

Prob. LXXIX.

There is a triangle as ABC. and from the end A. there runnes a right line, as A D E. Now it is required from E to drawe a line to ſome part of the baſe A C. (as E F.) in ſuch ſort that the triangle A E G. may be equall to the Trapezia B C F G.



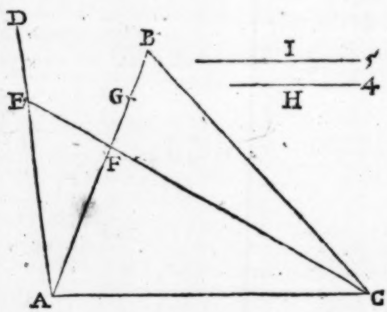
A C, 30.
p ſrō B. 20
A F. 24.
p ſrō. E. 25

First drawe the pricked line E C. then by B. drawe a parralell to the base A C. to cut the line A E. in D. that done, by D. drawe a parralell to E C. to cut the
57.1. base A C. in F. Lastly, drawe the line E F. so shall the triangle AE G. be equall to the Trapezia B C F G. required.

Prob. LXXX.

There is a triangle as A B C, & from A. runneth a line as A D. now it is required from the angle C. to drawe a line to some part of A D. (as C E.) in such sort that the triangle A F C. cut off, together with the triangle AEF. taken in, (viz. the whole triangle CAE) may haue proportion to the triangle giuen, as the line H. to the line I.

A B. 40
p. frõ C. 45
A C. 48
p. frõ E. 30
A G. 32.
p frõ C. 45

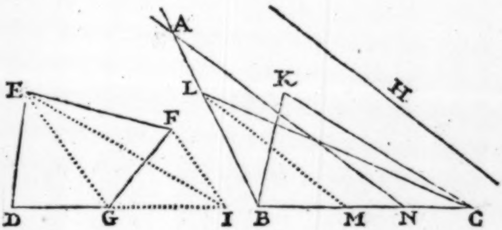


By the 23. Probleme say, if I. giue H. what AB? answer A G. then by G. drawe a parralell to
12.6. the base A C. to cut the line A D. in E. Lastly,
37.1. drawe C E. so shall you include the triangle C AE. which performeth your desire.

Prob. LXXXI.

Prob. LXXXI.

There is an angle as A B C. from the which it is required to cut off a part, equall to the Trapezia DEFG with a parralell to the line H.



D I. 45.
p. frõ E. 24
BC. 45.
p. frõ K. 24
p. frõ L. 24
BN 30.
p. frõ A. 36

First reduce the Trapezia by the 47. Probleme into the triangle D E I. which triangle set in the angle CB A. beginning at B. as appeareth by the triangle CBK. that done, by the 38. Probleme, reduce the triangle C BK. into the triangle C BL. hauing the same base C B. but the angle at B. equall to the giuen angle C B A. that done, by L. drawe a parralell to H. the line giuen, to cut B C. in M. then finde a meane proportion, betweene B M. and B C. as B N. Lastly, by N. drawe a parralell to H. as N A. to cut the side B L A. in A. so shall you cut off from the angle A B C. the triangle A B N. equall to the Trapezia D E F G. with a parralell to the giuen line H. as was required.

Prob. LXXXII.

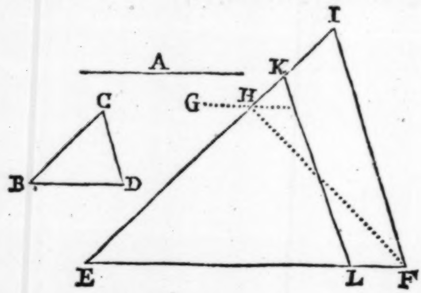
A figure being giuen, to make an other in Area *equall thereunto, but like a figure giuen.*

Let the line A. be the side of some square giuen, and

 let

let it be required to reduce the ſame into a triangle, like the triangle B C D. with all his angles, and ſides proportionall.

EF. 60.
p.frō H 30.
EL. 50.
p.frō K,36



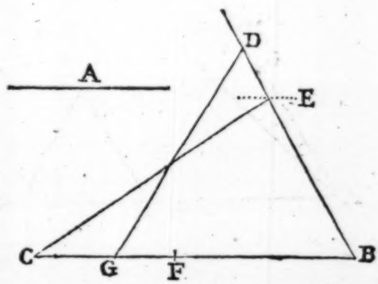
FIrſt lay downe the diſtance of the line A. twiſe from E. to F. then at the diſtance of the line A. drawe a parralell to E F. as the pricked line G. That done, from the end E. protract an angle equall to the angle B.(of the giuen triangle B C D.) as the angle F E H. to cut the parralell G, in H. and drawe the pricked line H F. ſo ſhall the triangle E H F. be equall to that ſquare, whoſe ſide is the line A. that done, from the end F. protract an angle equall to the angle D. (of the leſſer triangle) as the angle E F I, to cut E H. being drawne forth in I. ſo ſhall the triangle E F I. be like the little triangle B C D. but more in *Area* then the triangle E H F (which is equall to the ſquare giuen) therefore to make one equall thereunto, Finde a meane proportion betweene E H. and E I. which is E K. then by K. drawe a parralell to I F. as K L. ſo ſhall the triangle E K L. be equall to that ſquare whoſe ſide is the line A. and hauing all his angles like the angles of

of the giuen triangle B C D. which was required.

Prob. LXXXIII.

To make an Equilaterall triangle, equall to a Square.

Let A. be the ſide of a ſquare giuen, and it is required to make an Equilaterall triangle equall thereunto.



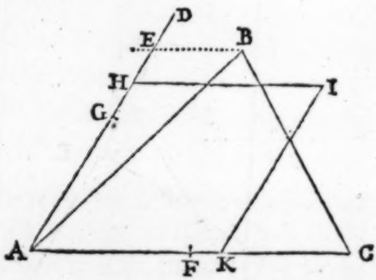
First, drawe the line B C. iuſt of twiſe the length of the giuen line A. then from the end B. protract an angle equall to the angle of an equilaterall triangle, as C B D. that done, at the diſtance of the line A. drawe a parralell to C B. as the pricked line E. to cut B D. in E. then ſet that diſtance B E. from B. to F. Laſtly finde a meane proportion betweene B F. and B C. which is B G. which ſet from B to D. and drawe the line G D. ſo ſhall you include the Equilaterall triangle B D G. equall to C B E. or the ſquare giuen, whoſe ſide is A. which was required.

Prob. LXXXIIII.

Prob. LXXXIIII.

To make a Rombus equall to a Triangle giuen.

Let A B C. be a triangle giuen, and it is required to make a Rombus equall thereunto.



First from the end A. protract an angle equall to one of the acute angles of the Rombus, which is the angle of an Equilaterall triangle (as the angle C A D.) then by the point B. drawe a parralell to the base A C. to cut A D. in E. that done, take alwaies $\frac{1}{2}$ the base A C. (as A F.) and set that vpon the line A D. from A. to G. Lastly, betweene A G. and A E. finde a meane proportion, as A H. (for the side) wherof make the Rombus A H I K. which shall be equall to the giuen triangle A B C. required.

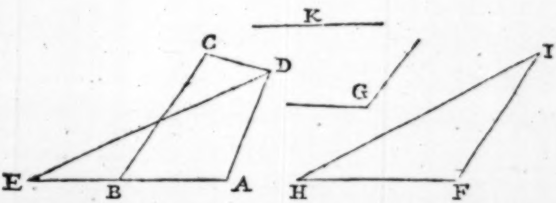
These 4. last Problemes haue their demonstration out of the 37. 1. and the cor: of the 19. 6. of Euclid.

Prob. LXXXV.

Prob. LXXXV.

To reduce a Trapezia into a Triangle, whose base is limmited, and yet shall haue an angle equall to an angle giuen.

Let ABCD. be a Trapezia giuen, and let it be required to make a triangle equall thereunto, whose base shall be the line HF. and hauing one angle, equall to the angle G.



E A 48.
p frō D. 25
H F. 40.
p. frō I. 30
K. 30.

First by the 47. Probleme, reduce the Trapezia into the triangle DAE. then from the end F. (of the giuen line HF.) protract an angle equall to the angle G. as the angle HFI. by drawing the line FI. that done, say by the 23. Probleme, if HF. giue EA. what the perpendicular from D. vpon the base EA. (being increased?) answer the line K. at which distance, drawe a blinde parralell to HF. to cut FI. in I. Lastly, drawe HI. so shall you include the triangle HFI. equall to the Trapezia ABCD. and hauing one angle equall to the giuen angle G. which was required.

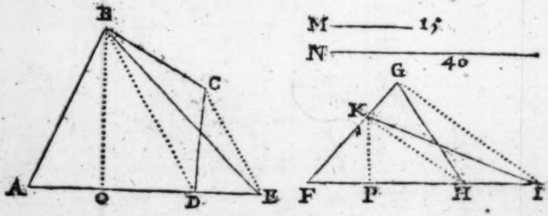
37.1.
23.1
12.6
31.1

Prob. LXXXVI.

Two figures being giuen, and a right line, to finde another line in proportion, to the line giuen, as the one figure to the other.

Let A B C D. and F G H. be two figures : alſo, let M. be a line giuen. Now it is required to finde another line in proportion to M. as the Trapezia ABCD. to the triangle F G H.

AE. 45.
p. BO. 32.
FH. 30.
p fro G. 18.
FI. 45.
p. KP. 12.



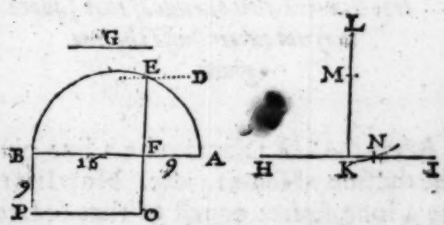
BY the 47. Probleme, bring the Trapezia ABCD. into the triangle A B E. whoſe baſe is A E. and let fall his perpendicular B O. Then reduce the triangle F G H. into another triangle, whoſe baſe may be equall to the ſaid baſe AE. as into the triangle FKI.
37.1. and let fall his perpendicular KP. ſo ſhall the triangle
1.6. FKI. or F G H (becauſe they are equall) be in propor-
12.6. tion to the Trapezia as the perpendicular K P. to the perpendicular BO. Now if KP. were equall to the line M. then B O ſhould be the line required, but for as much as it is not, therefore ſay by the 23. Probleme, if KP. were the line M. what B O? anſwer, the line N. and ſo is found that the line N. hath the ſame proportion

tion to the line M. as the Trapezia A B C D. to the triangle F G H. which was required.

PROB. LXXXVII.

To deuide a line giuen into two such parts, that another line (so it be not aboue halfe the giuen line) may be a meane proportion betweene the parts.

Let AB. be a line giuen, to be deuided into two such parts, that the line G. may be a meane proportion betweene those parts.



G. 12.

VPon the line AB. describe the semi-circle AEB. then at the distance of the line G. drawe a parralell to AB. as the pricked line D. to cut the Circomference in E. Lastly, let fall the perpendicular EF. which cutteth AB. into two parts in F. so is AF. and FB. the two parts required. G. equall to EF. 13.6.

Or thus:

Againe, in the same Diagram, let HI. be the line, & let it be so deuided, that the line G. may be a meane betweene the two parts.

DEuide HI in the midst in K. & vpon K. erect a perpendicular at length, as KL. that done, set the line G. from K. to M. then take $\frac{1}{2}$ HI. viz. HK, or KI. and setting one foot in M. with the other crosse the line HI. in N. so shall IN. be the lesser part, and NH. the greater.

PROB. LXXXVIII.

To reduce a square into a long square, whose length and breadth is limmited in a straight line, wherein is to be noted, that the side of that square may not exceed halfe the line giuen.

Let AB in the last Diagram be a line giuen, and let G. be the side of some square. Now it is required to make a long square equall to that square whose side is the line G. and yet the length and breadth thereof together shall make but the line AB.

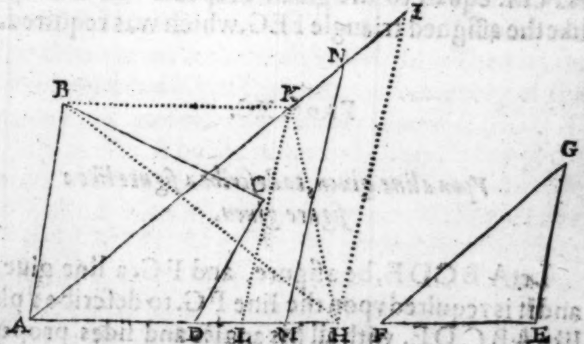
DEuide the line AB. as before taught in F. in such sort, that the line G. may be a meane proportion betweene the parts AF. and FB. so shall AF. be the breadth and FB. the length, whereof
47. 1. make the long square BFOP. which shall be equall
13. 6. to that square whose side is the line G. and yet the length BF. and the breadth FA. together, shall make but the giuen line AB. as was required.

PROB. LXXXIX.

PROB. LXXXIX.

To make a Triangle equall in Area, to a figure giuen, and yet like a Triangle assigned.

Let A B C D. be a figure giuen, and it is required to make a triangle equall thereunto, but like the triangle E F G.



A H, 36.
p. frõ B. 25
p. frõ K 25
A L, 25.
A M. 30.
p. frõ N. 30.

BY the 47. Probleme bring the Trapezia A B C D. into the triangle A B H. then from the end A. protract (by the 7. Problem) an angle, as the angle H A I. equall to the angle F. of the giuen triangle, by drawing the line A I. Againe from the end H. (of the base A H.) protract an angle equall to the angle E. by drawing the line H I. (as the angle A H I) so shall you include the triangle A I H. like the giuen triangle E F G. but not equall to the Trapezia: for it is too big. Therefore from B. drawe a parralell to

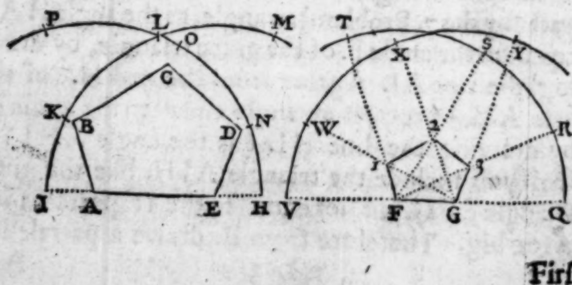
37. I.
23. I.
Cor. 19. 6

A H. as B K. to cut A I. in K. then drawe K H. so shall the triangle A K H. be equall to the triangle A B H. or the Trapezia A B C D. but that hath not the angle at H. equall to the angle E. of the giuen triangle: therefore drawe by the point K. a parralell to I H. as K L. to cut A H. in L. that done, betweene A L. and A H. finde a meane proportion which is A M. Lastly, from the point M. drawe a parralell to H I. as M N. to cut the side A I. in N. so shall you include the triangle A N M. equall to the giuen Trapezia A B C D. and like the assigned triangle F E G. which was required.

Prob. XC.

Vpon a line giuen, to describe a figure like a figure giuen.

Let A B C D E. be a figure, and F G. a line giuen, and it is required vpon the line F G. to describe a plot like A B C D E. with all his angles and sides proportionall.



First,

FIrst extend the base A E. on both sides at pleasure, as to H. and to I. then setting one foot in E. make the arch I K L M. Set also one foot in A. and with the same distance make the arch H N O P. that done, lay the Rular by the angle A. and euery of the points E D C B. and marke the arch H N O P. in the points H N O P. Then lay also your Rular by the angle E. and euery of the points A. B. C. D. and marke the arch I K L M. in the points I K L M. Then, with the distance A H. or E I. setting one foot in F. make the arch Q R S T. Also, setting one foot in G. with the same distance make the arch V. W. X. Y. Then lay the Rular by the end F. (of the line F G.) and euery of the points R S T. and drawe the blinde lines F R. F S. F T. lay also the Rular by the other end G. and euery of the points W. X. Y. & drawe other blinde lines to crosse those blinde lines in the points 1. 2. 3. Lastly, drawe the lines F 1.|1. 2.|2. 3|3. G.| so shall you include the figure F. 1. 2. 3. G. like the figure A B C D E. vppon the giuen line F G. which was required.

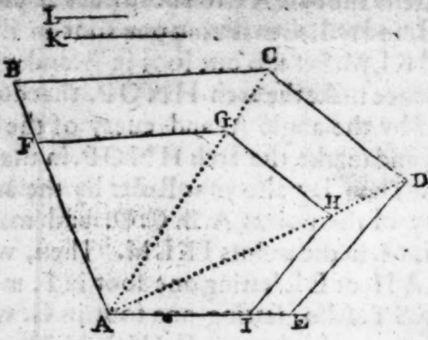
And in the same manner might you increase a plot, by making the line F G, longer, and then worke as before.

PROB. XCI.

To increase or decrease a figure giuen, according to any proportion required.

Let A B C D E. be a plot giuen, to be made lesse in proportion, as L. to K.

By



P. 52.

BY the 52. Probleme, deuide one of the ſides (at AB) in power as L. to K. in ſuch ſort, that the power of A F. may be to the power of A B. as L. to K. Then from the angle A. drawe lines to the points C. and D. that done, by F. drawe a parralell to B C. to cut A C. in G. (as F G.) Againe, from G. drawe a parralell to C D. to cut A D. in H. Laſtly, from H. drawe a parralell to D E. to cut A E. in I. ſo ſhall the plot A F G H I. be like A B C D E. and in proportion to it as the line L. to the line K. which was required.

And if the leſſer plot were giuen, and it be required to make a greater in proportion to it, as K. to L. then from the point A. drawe the lines A C. and A D at length (alſo increaſe A F. and A I.) that done, by the 53. Probleme, inlarge A F. in power, as K. to L. which ſet from A. to B. then by B. drawe a Parralell to F G. to cut A C. in C. (as B C.) Likewiſe from C. a parralell to G H. to cut A D. in D. (as C D.) Laſtly, a parralell from D. to HI. (as D E.) to cut A I. (being increaſt in E.) ſo ſhall you include the plot ABCDE.

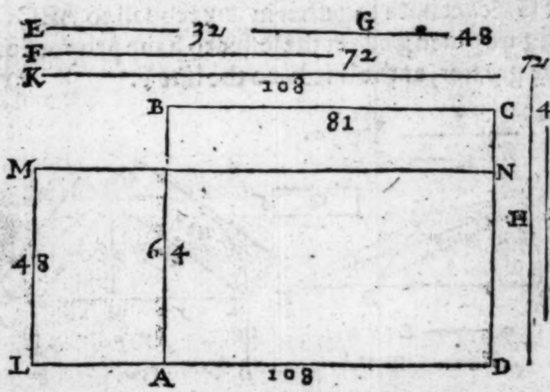
like

like AFGHI. and in proportion thereunto as the line K to the line L. which was required.

Prob. XCII.

To reduce a long square into another long square, whose breadth shall haue proportion to his length, as one giuen line to another.

Let AB C D. be a long square giuen, to be reduced into another long square, whose breadth shall haue proportion to his length, as the line E. to the line F.



First by the 26. Probleme, finde a meane proportion betweene the giuen lines E. and F. which is G. finde also a meane betweene the breadth A B. and the length B C. which is H. That done, say by the 23. Probleme, if G. giue H. what F? answer the line K. for the length: Say againe, by the same rule, if G.

13
12
14 } 6.

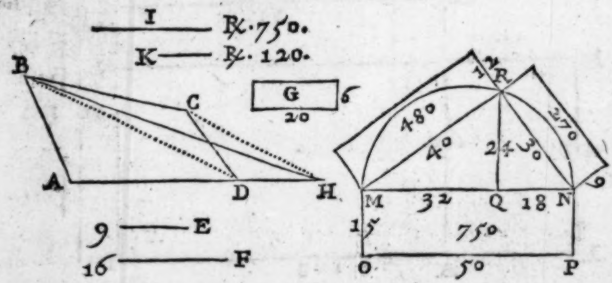
giue

giue H. what E? answer the line I. for the breadth: then of the lines I. K. make by the 14. Probleme, LMND. which shal be equal to the giuen long square ABCD. and yet the breadth to the length in proportion as the line E. to the line F. which was required.

Prob. XCIII.

A figure being giuen, to make two other figures equall to it, but each of those two, like another figure giuen, and yet the lesser to the greater in proportion as one giuen line to another.

Let ABCD. be a Trapezia giuen, and it is required to make two other figures each to be like the figure G. & yet both together in *Area* equall to ABCD. the figure giuen, and yet the lesser to haue proportion to the greater, as the line E. to the line F.



First by the 47. Probleme, reduce the Trapezia into the triangle ABH. then that triangle by the 43. Probleme into a square, whose side will be the line I. that done, by the 40. Probleme reduce the figure G. also, into a square, whose side shall be the line K. Then reduce the giuen Trapezia ABCD. into a long square like G. after this manner. Say by the 23. Probleme, if

K. giue

K. giue I. what the longer ſide of the figure G? anſwer the line M N. for the length, ſay againe, if K. giue I. what the breadth of the ſaid figure G? anſwer M O. for the breadth, whereof by the 14. Probleme, make the long ſquare M N P O. which ſhall be equall to the Trapezia A B C D. and like G. the figure giuen. Then for as much, as the figures to be made like G. are to haue proportion together as E to F. therefore by the 24. probleme, deuide the length of the long ſquare M N O P. equall to the Trapezia giuen, viz. M N. in Q. into two parts in proportion as E. to F, viz. that as E. to F. ſo N Q. the leſſer part to Q M. the greater. That done, vpon the line M N. deſcribe the ſemicircle M R N. and vpon the point Q. erect a perpendicular to cut the lymbde or Circomference in R then drawe the lines N R. and M R. which ſhall be the length of the figures to be made. Vnto which lengths M R. and R N. finde their breadths by the 23. probleme thus, ſay if the length of the giuen figure G giue his breadth, what M R? anſwer his breadth which is the line 12. then of the line M R. and the line 12. make the long ſquare 480. Say againe, if the length of the figure G. giue his breadth, what R N? anſwer the line 9. for the breadth of the long ſquare whoſe length is R N. Then of the lines R N. as the length and the line 9. as the breadth, make the long ſquare 270. which two long ſquares, viz. 480. and 270 are both like the giuen figure G. and together containe in *Area* ſo much as the giuen Trapezia ABCD. and yet the leſſer figure 270. is in proportion to the greater 480. as the line E. to the line F. which was required.

31.3.
31.6
8.6
4.6
Cor. 19.6.

Now followeth a Compleat Instruction of the deuision of all right lined figures, in diuers kindes, being performed after a better way then by any former Writer.

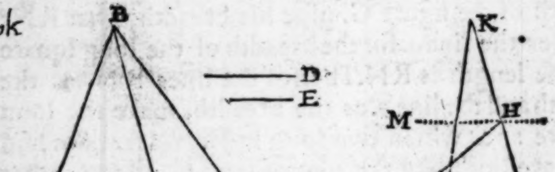
Very pleasant, and full of delight in practise: Also, most profitable to all Surueighers, or others that are desirous to make any Inclosure.

Prob. XCIIII.

To deuide a Triangle according to a proportion assigned, with a line drawne from an angle giuen.

Let A B C. be a triangle giuen, to be deuided into two parts in proportion one to the other, as the line D. to the line E.

Pr 1st Book
Euc {6. 1
Ra. {10.13



By

BY the 24. Probleme, deuide the base A C, in F: as D. to E. then drawe the line BF. so shall you deuide the triangle into two parts, as D. to E. required, for as D. to E. so the triangle A B F. to the triangle B C F, &c. P. 24. 1. 6.

Prob. XCV.

To cut off from a triangle, a part equall to a figure giuen, and to lay the part cut off towards any place appointed.

Let in the last Diagram A B C. be a triangle giuen, from the which it is required to cut off so much as the triangle G H I. containeth, and to lay the part cut off next C.

INcrease the side I H. at length, then by the 46. Probleme, reduce the triangle G H I. into the triangle K I L. whose perpendicular may bee of the length of the perpendicular of the giuen triangle A B C. from B. vpon his base AC. That done, take the base I L. & set it from C. to F. (because it is required to lay the part cut off next C.) Lastly, drawe B F. so shall the triangle B C F. be cut off, lying next C. and be equall to the giuen triangle G H I. which was required.

Hence also may be gathered, how to cut off from a figure giuen, any number of Acres, Roods, Poles &c. and to lay them towards a place appointed: For suppose $\frac{A}{3}$ $\frac{R}{1}$ $\frac{P}{1}$. were to be cut off, and to be layd next C.

First, make any triangle at pleasure, that may containe $\overset{A}{3}\ \overset{R}{1}\ \overset{P}{20}.$ being made by the same scale whereby the triangle ABC. was layd downe. As let the triangle GHI. containe $\overset{A}{3}\ \overset{R}{1}\ \overset{P}{20}.$ and then as before taught, cut off from the triangle giuen, ABC. a part equall to the triangle GHI. as BFC. and lay it next C. so shall you cut off $\overset{A}{3}\ \overset{R}{1}\ \overset{P}{20}.$ which was required. The like is to be vnderstood in all the examples following.

But here it will be necessarie to shew the learner how to make a triangle to containe a nomber of Acres, Roods, Poles, &c.

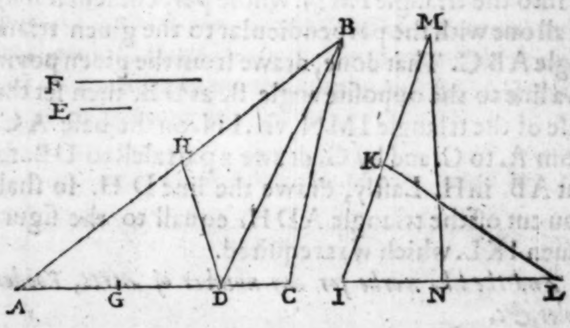
As now to make the triangle GHI. to containe $\overset{A}{3}\ \overset{R}{1}\ \overset{P}{20}.$ Therefore proceed thus: Bring the 3. Acres, and 1, Roode into Roods, by multiplying the 3. Acres by 4. and adding in the 1. roode, saying 4. times 3. is 12. and 1. is 13. so doth 3. Acres and 1. roode containe 13. rood: Which 13. bring into Poles by multiplying them by 40. and adde in the 20. Pole (because 40. Pole make one roode) so finde you 540. Poles to be contained in $\overset{A}{3}\ \overset{R}{1}\ \overset{P}{20}.$ Now are you to make some kinde of triangle to containe 540. poles, which is thus done, double alwaies your number of poles, viz. now 540. maketh 1080. then take for the base of your triangle any number at pleasure, as 40. by which deuide 1080, the double of the poles to be brought into a triangle: and your quotient is 27. which shall be the perpendicular, to that triangle whose content shall be $\overset{A}{3}\ \overset{R}{1}\ \overset{P}{20}.$ and the base 40. as before. Therefore lay downe the base 40. any where, as in the former Diagram, from G. to I. then at the distance of 27. your quotient, drawe a parralell thereunto as the pricked line MH. that done, take any point in that parralell as the point H. from whence drawe lines to G. and I. the ends of the base, as GH. and HI. so shall you include the triangle GHI. which shall containe $\overset{A}{3}\ \overset{R}{1}\ \overset{P}{20}.$ as was required.

Prob. XCVI.

To deuide a triangle giuen into two parts in proportion according to two lines giuen, with a line drawne from a point in any side assigned.

Let A B C. be a triangle giuen, and let D. be a point assigned in the side A C. from whence it is required to drawe a line to deuide the triangle into 2. parts, hauing proportion one to the other, as the lines E. and F.

Euc. 6. 1
Ram. 10. 13
Ceul. 3. 9.



First deuide the line or base A C. in G. as E. to F. by the 24. probleme, then drawe from the opposite angle B. a line to the giuen point D. as B D. that done, by the point G. drawe a parralell thereunto to cut the side A B. in H. Lastly, drawe the line D H. so shall you inclose the triangle A D H. which shall be in proportion to the rest D C B H. as the line E. to the line F. which was required.

I. 6.
37. 1.

Prob. XCVII.

To cut off from a triangle giuen, a part equall to a figure giuen, with a line drawne from a point in any side assigned.

Let in the last Diagram A B C. be a triangle giuen, and let D. be a point assigned, in the side A C. from whence it is required to drawe a line to some part of the side A B. as D H. to inclose a part equall to the triangle I K L.

First, by the 46. probleme, bring the triangle I K L. into the triangle I M N. whose perpendicular may be all one with the perpendicular to the giuen triangle A B C. That done, drawe from the giuen poynt D. a line to the opposite angle B. as D B. then set the
P. 24. base of the triangle I M N, viz. I N. on the base A C.
37. 1. from A. to G. and by G. drawe a parralell to D B. to
1. 6. cut A B. in H. Lastly, drawe the line D H. so shall you cut off the triangle A D H. equall to the figure giuen I K L. which was required.

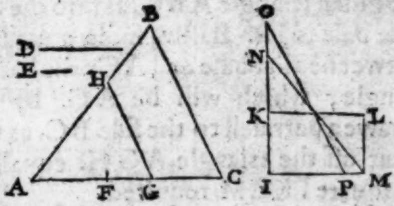
And the like worke for any number of Acres, Roodes, Poles, &c.

Prob. XCVIII.

To deuide a triangle giuen, according to a proportion assigned with a parralell to one of his sides.

Let A B C. be a triangle giuen, and it is required to deuide it into two parts in proportion one to the other, as the line D. to the line E. with a parralell to the side B C.

Deuide



DEuide the base A C. in F. as D. to E. that as D. to E. so C F. may be to F A. then finde a meane proportion by the 26. Probleme, between A F, and A C. which is A G. Lastly, by G. drawe a parralell to the side C B. as G H. so shall you cut off the triangle A G H. hauing proportion to the rest B C G H. as E. to D. which was required.

10. 6.
13. 6.
Cor. 19. 6.

PROB. XCIX.

To cut off from a triangle, a part equall to a figure giuen, with a parralell to one of his sides.

Let in the last Diagram A B C. be a triangle giuen, from the which it is required, to cut off so much as the long square I K L M. with a parralell to the side B C.

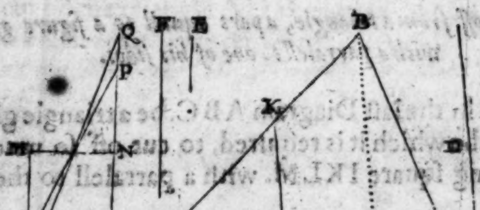
FIrst increase the side of the long square I K. at length to O. then set twise the breadth from I. to N, and drawe the line N M. so shall you include the triangle N I M. equall to the long square giuen, which triangle reduce againe into a triangle,

whose perpendicular may be equall to the perpendicular of the giuen triangle A B C. as into the triangle I O P. whose base is I P. Lastly, finde a meane proportion betweene that base and A C. the base of the giuen triangle, which will be A G. by which point G. drawe a parralell to the side B C. as G H. so shall you cut off the triangle A G H. equall to the giuen long square I K L M. required.

PROB. C.

To deuide a triangle (with a parralell to a line giuen) according to any proportion assigned betweene two lines.

Let A B C. be a triangle, and D. a line giuen, and it is required to deuide the same into two parts with a parralell to D. in proportion one to the other, as the line E. to the line F.



By the 24. Probleme deuide the base A C. in G. as E. to F. then by B. drawe a parralell to the line D. as the pricked line B H. to cut A C. in H. That done,

done, betweene A G. and A H. finde a meane proportion, as A I. then by the point I. drawe a parralell to the giuen line D. as I K. so is cut off the triangle A I K. which shall be in proportion to the rest C B K I. as E. to F. which was required.

P.24 1.6 Cor. 19.6.

Prob. CI.

To cut off from a triangle, a part equall to a figure giuen, with a parralell to a line assigned.

Let in the last Diagram A B C. be a triangle giuen, and let it be required to cut from it a part equall to the square LMNO with a parralell to the line D.

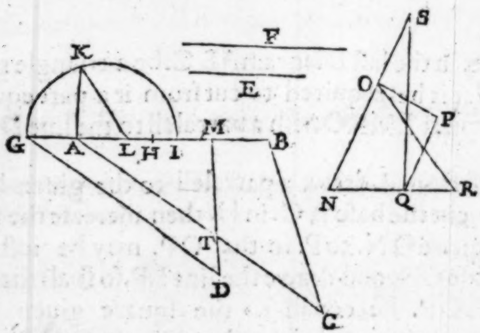
FIrst from B. drawe a parralell to the giuen line D. to cut the base A C. in H. then increase the side of the square O N. to P. so that O P. may be iust twise the side O N. and drawe the line L P. so shall the triangle L O P. be equall to the square giuen. Then reduce that triangle into the triangle O Q R. whose perpendicular O Q. may be equall to the perpendicular of the triangle A B C. that done, take the base thereof, viz. O R. and set that vpon the base A C. (of the giuen triangle) from A. to G. then finde a meane proportion betweene A G. and A H. as A I. and by the point I. drawe a parralell to the line D. as I K. which shall cut off the triangle A I K. equall to the square giuen, as was required.

37.1 p.24 1.6 Cor. 19.6.

PROB. CII.

To deuide a triangle into two parts, according to any proportion giuen, with a line drawne from a point assigned without the triangle.

Let A B C. be a triangle giuen, and D. a point without, from whence it is required to drawe a line to deuide the triangle into two parts in proportion one to the other, as the line E. to the line F.



FIrst increase the side B A. to G. Then by the point D. drawe a parralell to C A. as D G. to cut B A. being increased in G. that done, deuide A B. in H. as E.
12. 6. to F. that as E. to F. so A H. to H B. then, by the
13. 6. 23. Probleme, say if G D. giue A C. what A H? an-
47. 1. swer A I. which set from A. to I. that done, finde a
16. 6. meane proportion betweene G A. and A I. as A K. then deuide alwaies A I. into two equall parts in L. and

and drawe K L. which set from L. to M. Lastly, from the point D. to the point M. drawe the line D M. so shall you cut off the triangle A M T. which shall be in proportion to the rest C B M T. as the line E. to the line F. which was required.

Prob. CIIII.

To cut off from a triangle a part equall to a figure giuen, with a line drawne from a point assigned without the triangle.

Let in the last Diagram A B C. be a triangle giuen, and D. a point without, from the which it is required to drawe a line to cut off from the triangle A B C. a part equall to the Trapezia N O P Q.

First increase B A. to G. then by the giuen point D. drawe a parralell to C A. as D G. to meet with B A. being increased in G. that done, by the 47. Probleme, bring the Trapezia into the triangle N O R. Then that triangle againe into the triangle N S Q. whose perpendicular may be equall to the perpendicular of the giuen triangle A B C. from C. vpon A B. (being increased) that done, take the base thereof viz. Q N. and set it on the base A B (of your triangle giuen) viz. from A. to H. Then say by the 23. probleme, if G D. giue A C. what A H ? answer A I. which set from A. to I. that done, finde a meane proportion betweene A G. and A I. as A K. and deuide alwaies the line A I. into two equall parts in L. then drawe K L. which set from L. to M. Lastly, from the giuen point D. to M. drawe

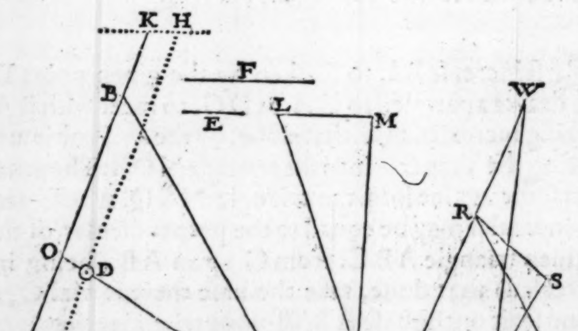
37. 1.
12. 6.
13. 6.
47. 6.
16. 6.

drawe the line DM. which cutteth off the triangle ATM. equall to NOPQ. the Trapezia giuen, as was required.

Prob. CIIII.

Through a giuen point within a triangle, to drawe a line to deuide the triangle according to any (possible proportion) betweene two lines giuen.

Let ABC. be a triangle giuen, and D. a point within, through the which it is required to drawe a line to deuide the triangle into two parts in proportion one to the other, as the line E. to the line F.



First consider through which sides the line of partition OP. must passe, which will be AB. and AC. then by the point D. drawe a parralell to AB.

as G H. to cut the base A C. in G. that done, by the 24. probleme, deuide the base A C. in I. as E. to F. Then say by the 23. probleme, If A G. (that part of the base cut by the parralell H G. adioyning to that side, vnto which the parralell was drawne, viz. A B.) giue the $\frac{1}{2}$ perpendicular from B. vpon the base A C. what A I? answer, a line, at the distance wherof, drawe a parralell to the base A C. as the pricked line K H. 29.1
to cut the side A B. if it may, if not, increase it till it 26.1
meet with that parralell in K. Then note where the 4.6
two parralells viz. G H. and K H. meet, which is in 31.6.
the point H. That done, take by the 55. probleme, the square of G D. from the square of D H. rest in the right angled triangle L M N. the square of M N. which take, and set vpon the side A B. being increased from K. to O. Lastly, lay your Rular by the points O. and D. and drawe the line O D P. so shall you cut off the triangle A O P. which shall haue proportion to the part remaining O B C P. as the line E. to the line F. which was required.

Prob. CV.

To cut off from a triangle with a line drawne through a point within, (if it be possible) a part equall to a figure giuen.

Let A B C. in the last Diagram, be a triangle giuen, from whence it is required to cut off so much as the figure Q R S T. with a line drawne through the point D. within.

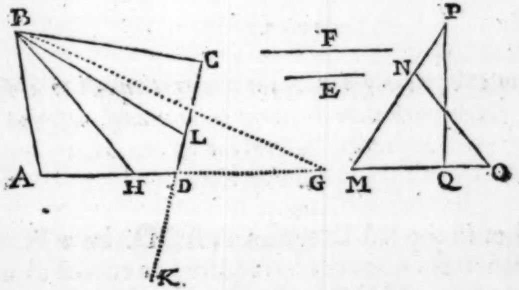
First,

FIrst bring the figure giuen into a triangle by the 47. Probleme, as into the triangle QRV. then, that triangle into the triangle Q T W. whose perpendicular from W. may be equall to the perpendicular from B. vpon the base A C. of the giuen triangle, so is the base of that triangle Q T W. the line Q T. then seeing so much as the triangle Q T W. is to be cut off with a line drawne through the point D. therefore consider through which sides of the triangle A B C, the line of partition O P. shall passe, which will be the sides A B. and A C. therefore by D. drawe a parralell to A B. as G H. that done, set the base of the triangle Q T. W. (equall to your figure giuen to be cut off) from A. to I. (vp on the base A C.) Then say by the 23. Probleme, if A G. (the part of the base
37.1 cut by the parralell H G. adioyning to the side A B.
29.1 whereunto that parralell was drawne) giue the ½ per-
26,1 pendicular from B. vpon A C. what A I? answer a line,
4.6
31.6. at the distance whereof, drawe a parralell to the base A C. as the pricked line K H. to cut the side A B. if it may, & if not, increase it till it do meet with that parralell, then note where those two parralels meet, viz. G H. and K H. which is in H. that done, take the square of G D. from the square of D H. so rest the line M N. (in the right angled triangle L M N) for the side of a square equall to the remainder, which line M N. take, and set from K. to O. vpon the side A B. being increast. Lastly, lay your Rular by the points O D. and drawe the line O D P. which cutteth off the triangle A O P. equall to Q R S T. the figure giuen, which was required.

Prob. CVI.

To deuide a Trapezia giuen, according to any proportion betweene two lines, with a line drawne from an angle assigned, and to lay the part cut off towards a place appointed.

Let A B C D. be a Trapezia giuen, the which is to be deuided into two parts, as E. to F. with a line drawne from the angle B. and to lay the lesser part next A.



Reduce the Trapezia into the triangle A B G. by the 47. probleme, whose base is the line A G. being increased to G. which AG. by the 24. probleme, deuide in H. as E. to F. then drawe the line B H. so shall you cut off the triangle A B H. which shall be in proportion to the part remaining BCDH. as the line E. to the line F. as was required. 37.1 10.6 1.6

But if the greater part were required to be left towards A. then the line of partition drawne from B. will light vpon the side C D. and then must you re-

duce your Trapezia into a triangle, making CD. (increased the base) therfore by the 47. Probleme finde the point K. so is CK. the whole base, then deuide CK. in L. as E. to F. by the 24. Probleme, and drawe the line BL. so shall BCL. the lesser part, lye next C. and BADL. the greater next A. and be in proportion one to the other, as E. to F. which was required.

And if it were to drawe a line from the angle C. then the side BA. must haue bene increased, and the Trapezia brought into a triangle by the 47. probleme whose base must be the side BA. increased, and then worke as before taught.

Prob. CVII.

From a Trapezia giuen, to cut off a part equall to a figure giuen, with a line comming from an angle assigned and to laye the part cut off towards a place appointed.

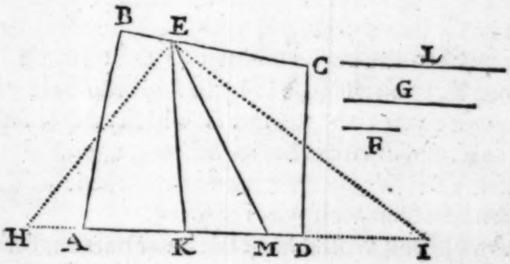
Let in the last Diagram ABCD. be a Trapezia giuen, from whence it is required to cut off so much as the figure MNO. and to lay the part cut off next A.

By the 46. probleme, reduce the triangle MNO. into the triangle MPQ. whose perpendicular may be equall to the perpendicular of the triangle ABG. (from B. vpon the base AG.) then take the base of that triangle viz. QM. and set it from A to H.
37.1. and drawe the line BH. so shall the triangle ABH.
1.6. be cut off with a line drawne from the angle B. and be layd next A. whose content shall be equall to the giuen figure MNO. which was required.

Prob. CVIII.

To deuide a Trapezia into two parts, according to any proportion required, with a line drawne from a point, assigned in any of his sides.

Let A B C D. be a Trapezia giuen, and let E. be a point assigned in the side B C. from the which it is requird, to drawe a line that shall deuide the Trapezia into two parts, as F. to G.



First increase the base both waies to H. & to I. then from the point E. by the 47. probleme, drawe the lines E H. and E I. and bring the Trapezia into the triangle H E I. whose base shall be H I. the which deuide in K. by the 24. probleme, as F. to G. 37.1
Lastly, drawe the line E K. so shall you deuide the gi- 10.6
uen Trapezia A B C D. with a line drawne from the 1.6
point E. into two parts, viz. A B E K. and E C D K. in proportion one to the other, as the line E. to the line F. which was required.

PROB. CIX.

To cut off from a Trapezia, with a line drawne from a point in any of his sides, a part equall to a figure giuen.

Let in the last Diagram A B C D. be a Trapezia giuen, from whence it is required to cut off so much as a square made of the line G. containeth.

FIrst, by the 47. probleme, bring the Trapezia into the triangle H E I. Then reduce the square, whose side is G. into a triangle, whose perpendicular may
37. 1. be equall to the perpendicular of the triangle H E I.
10. 6. (from E. vpon the base H I.) so shall the base of that
1. 6. triangle come to be the line L. which take & set from H. to K. and drawe E K. So shall you cut off the Trapezia A B E K. equall to that square whose side is the giuen line G. which was required.

And if you would haue the lesser part cut off to be next D. then set the line L. from I. to M. and drawe E M. so shall you cut off the part E C D M. next D. which shall be in proportion to the rest A B E M. as F. to G. required.

Yet must I herein aduise you one thing, that if you intend to lay the part cut off next A. that then there is no necessitie, to reduce the whole Trapezia into a triangle, as to make the triangle H E I. but it may suffice to drawe the line E H. by the 48. probleme, to take in so much as it cuts off, and then reduce your figure giuen to be cut off, into such a triangle whose perpendicular may be equall to the perpendicular

from E.

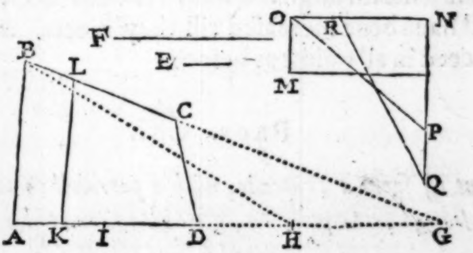
from E. vpon A D. and then the base of that reduced triangle being set from H. to K. and the line EK. being drawne, it performeth the demaund.

But this may be only done, when a figure giuen, or a summe of Acres is required to be cut off, but not when it is required, to deuide the plot into two parts in proportion, to two lines giuen, as the 108. problem requires, for then it is of necessitie to bring the whole Trapezia into a triangle, &c.

PROB. CX.

To deuide a Trapezia giuen, into two parts, with a parralell to one of his sides, in such proportion one to the other, as two lines giuen, and to lay the part required towards a place assigned.

Let A B C D. be a Trapezia giuen, to be deuided into two parts, with a parralell to the side A B. In such sort, as the lesser part may haue proportion to the greater, as the line E. to the line F. and to lay the bigger part next D. and the lesser next A.



FIrst, consider through which two sides the line of partition KL. must passe, (for those two sides must alwaies be increased till they meet) which sides are A D. and B C. which increase till they meet in G. That done, by the 47. Probleme, reduce the Trapezia A B C D. into the triangle A B H. whose base is AH. or which is better, hauing found the point H. it suffiseth: and there is no need to drawe the line BH. for it doth but obscure and darken the worke, and is bet-
37.1 ter out then in, well then, hauing the point H. The
10.6 base of that triangle equall to the Trapezia shall be
1.6 A H. which deuide by the 24. Probleme in I. as E. to
13.6 F. viz. that as E. to F. so A I. the lesser part next A (because the lesser part is to be layd next A.) to I H. the greater part. That done, betweene G I. and G A. finde a meane proportion, as G K. Lastly, by the point K. drawe a parralell to the side A B. as K L. so shall you cut off the lesser part A B L K. (next A.) which shall haue proportion to the greater part K L C D. next D. as the line E. to the line F. as was required.

But if the part required to be cut off, had beene with a parralell to A D. then the line of partition would passe through the sides A B. and D C. which must haue bene increased till they meete, and then proceed in all points as before.

Prob. CXI.

To cut off from a Trapezia, with a parralell to one of his sides, a part equall to a figure giuen, and to lay the part cut off towards a place appointed.

Let in the last Diagram MN. be a long square giuen

giuen to be cut off, from the Trapezia A B C D. with a parralell to the side A B. and to lay the part cut off next A.

FIrst as before, consider through which sides the line of partition shal passe, which are BC. and AD which increase till they meet in G. That done, reduce the long square M N. into the triangle O N P. and that triangle againe into the triangle R N Q. (whose perpendicular N Q. may be equall to the perpendicular from B. vpon A H.) so shall his base be the line
N R. which take, and set from A. to I. (because it is to 37. 1
be laid next A.) That done, betweene G I. and G A. 13. 6
finde a meane proportion as G K. Lastly, from K. draw 1. 6
a parralell to the side AB. as K L. so shall you cut off the part A B L K. equall to M N. the long square giuen, which was required.

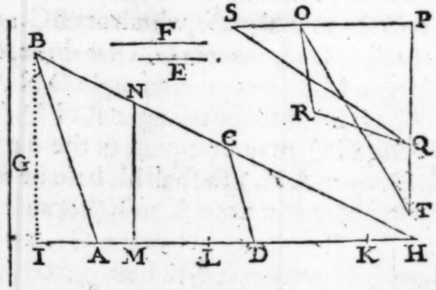
And if the part cut off equall to the long square M N. should haue bene laid next D. then you must first haue found the point H. and then haue set the distance N R. from H. towards A. and so haue proceeded as before, but seeing it is to lye next A. there is no need at all, to finde the point H. but only proceed as before taught, &c.

Prob. CXII.

To deuide a trapezia into two parts, according to any proportion betweene two lines, with a parralell to a line giuen, and to lay the part required towards a place assigned.

Let A B C D. be a Trapezia giuen, to be deuided into

into two parts in proportion one to the other, as the line E. to the line F. with a parralell to the line G. and to lay the greater part next D.



FIrst, consider through which sides the line of partition shall passe, which will be the sides A D. and B C. which increase till they meete in H. then by B. drawe a parralell to the giuen line G. as B I. to meete with the base D A. (being increased) in I. that
37.1 done, by the 47. probleme, finde the point K. vnto
10.6 which point a line drawne from B. should include a
1.6 triangle equall to the Trapezia giuen, so is A K. the
Cor. 19.6. whole base of that triangle, which deuide in L. as E. to F. and lay the bigger part K L. next D. (because it is so required) that done, betweene H L. and H I. finde a meane proportion, as H M. Lastly, by the point M. drawe a parralell to the giuen line G. as M N. so shall you deuide the Trapezia A B C D. into two parts, with a parralell to the line G. and lay the bigger part D C N M. next D. and the lesser part M N B A. next A. as was required.

PROB, CXIII,

Prob. CXIII.

To cut off from a Trapezia a part equall to a figure giuen, with a parralell to a line drawne by chaunce, and to lay the part cut off towards a place assigned.

Let in the last Diagram A B C D. be a Trapezia giuen, from whence it is required, to cut off so much as the figure O P Q R. with a parralell to the line G, and to lay the part cut off next A.

First consider, through which sides, M N. the line of partition shall passe, which are AD. and BC. which increase till they meet in H. that done, reduce OPQR your figure giuen to be cut off, into the triangle QPS by the 47. Probleme. & againe that triangle into the triangle O P T. by the 46. probleme, whose perpendicular P T. may be equall to the perpendicular from B. vpon H A. (being increased) so shall his base be 37. 1
P O. which take, and set vpon the base A K. from A. 1. 6
towards K. (because the part cut off must lye next A.) Cor. 19. 6.
endeth in L. then drawe from B. a parralell to the giuen line G. to cut the base H A. (being increased) in I. as the pricked line B I. That done, finde a meane proportion betweene H L. and H I. as H M. Lastly, by M drawe a parralell to the giuen line G. as M N. so shall you cut off next A. the part A B N M. equall to the giuen figure O P Q R. required.

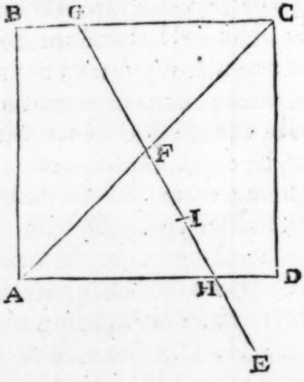
Note, that what hath bene said of a Trapezia, conserning the deuision, according to any proportion betweene two lines, or cutting off a part equall to a figure giuen, either with a

line drawne from any angle, from a point in one of the sides, or with a parralell to a line giuen, that the same may also be done to a square, long square, Rombus, or Romboides, being likewise figures of foure sides, &c.

Prob. CXIIII.

To deuide a square into two equall parts, with a line drawne from a point without the square.

Let ABCD. be a square giuen, and let E. be a point without, from whence it is required to drawe a line, which shall deuide the square into two equall parts.



First, drawe the Diagonall AC. which deuide
15.10 in the midst in F. then laying your Rular by the
29.1. points E. and F. drawe the line EHIFG. which shall
26.1 deuide the square into two equall parts, viz. ABGH and GCDH. both equall one to the other, with a line

line drawne from the point E. as was required.

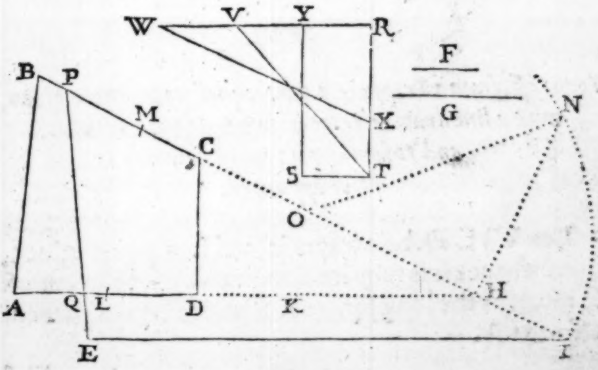
Note also, that if the point had beene in the side, or within the square, as in H. or I. that it is done in the same manner.

The like may be done to a long square, a Rombus, or a Romboides.

Prob. CXV.

To deuide a Trapezia according to any proportion giuen, with a line drawne from a point without the Trapezia, and to lay the part desired, towards a place appointed.

Let A B C D. be a Trapexia giuen, and let E. be a point without, from whence a line is to be drawne, to deuide the Trapezia into two parts, so that the lesser part may haue proportion to the bigger, as the line F. to the line G. and to lay the lesser part next A.



FOr as much as the line must be drawne from the point E. it must passe through the sides A D. and B C. therefore increase them till they meet in H. then by the point E. drawe a parralell to A H. as E I. to meet with B H. being drawne forth in I. that done, finde the point K. by the 47. probleme, so is A K. the base of a triangle, equall to the Trapezia, and the shortest distance from B. to A H. the perpendicular,
10. 6. then deuide A K. in L. as F. to G. (and because the
13. 6. lesser part cut off, is to lye next A.) therefore set the
47. 1. lesser part of the base so deuided from A to L. That
16. 6. done, say by the 23. probleme, if I E. giue H L. what H B ? answer H M. then finde a meane proportion betweene I H. and H M. as H N. that done, deuide alwaies H M. into two equall parts in O. and drawe the line O N. which set from O to P. Lastly, from the point E. to the point P. drawe the line E P. so shall you deuide the Trapezia into two parts, and the lesser part A B P Q. to lye next A. and to haue proportion to the greater part P C D Q. as the line F. to the line G. which was required.

Prob. CXVI.

To cut off from a Trapezia, a part equall to a figure giuen, with a line drawne from a point assigned without: and to lay the part cut off towards a place appointed.

Let A B C D. be a trapezia, and E a point giuen, from whence it is required, to drawe a line to cut off so much as the long square R S. and to lay the part cut off next A.

First

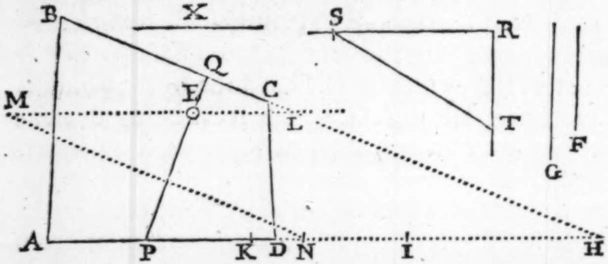
First consider, through what sides of the Trapezia, the line of partition E Q P. must passe, which may easily appeare to be the sides A D. and B C. the which increase till they meet in H. That done, by the point E. drawe a parralell to A H. to cut B C. being drawne forth in I. as before, then bring your long square giuen to be cut off into the triangle TRV. and againe, that triangle into the triangle R W X. whose perpendicular W R. may be equall to a perpendicular from B. (in the Trapezia) vpon the base A D. In which triangle W R X. the side R X. is the base, and R W. the perpendicular, which base take, and set from A. to L. vpon the base A D. (because the part cut off is required to be laid next A.) then say by the 23. probleme, if I E. giue H L. what H B? answer H M. and then to finde the point P. proceed altogether, as in the last probleme was taught, for there is no difference in the worke, then drawe E P. so shall you cut off the part ABPQ. equall to the giuen long square R T S Y. with a line drawne from the point E. as was required.

37.1
13.6
47.1
16.6

Prob. CXVII.

To deuide a Trapezia into two parts, (according to any possible proportion giuen) with a line drawne through a point within.

Let A B C D. be a Trapezia giuen, also let E. be a point within, and it is required to deuide the Trapezia, into two parts in proportion one to the other, as the line F. to the line G. with a line passing through the point E. within.



FIrst consider through which two sides the line of partition P E Q. must passe, which will be the sides A D. and B C. therefore increase them till they meet in H. that done, finde the base of a triangle equall to the Trapezia giuen, whose perpendicular may be the perpendicular from B. vpon A D. by the 47. probleme, which base will be A I. which deuide in K. according to your lines giuen, viz. that as F. to G. so I K. to K A. then by the point E. drawe a parrallell to A D. as L M. that done, let fall a perpendicular
37. 1 from E. to A D. or take the shortest distance from E.
10. 6 to A D. then say, by the 23. probleme, if that perpen-
12. 6 dicular or distance giue the perpendicular from B. v-
47. 1 pon A D. what the $\frac{1}{2}$ of H K? answer H N. which set
31. 6 from H. to N. by the which point N. drawe a parrallell to H B. as N M. to cut L M. in M. then take the square of E L. from the square of E M. by the 55. prob. the rest (which in the right angled triangle T R S) is R S. set from N. to P. then by P. and the point E. draw the line P E Q. so shall you deuide the Trapezia into two parts, with a line drawne through the point E. viz. Q C D P. the lesser, and Q B A P. the bigger part, and in such sort, that the lesser shall haue proportion to the bigger, as E. to F. which was required.

PROB. CXVIII.

Prob. CXVIII.

To cut off from a Trapezia, with a line drawne through a a giuen point within, (a possible part) equall to a figure giuen.

Le in the last Diagram A B C D. be a Trapezia, and E. a point giuen, and it is required to drawe a line through the point E. which shall cut off a part equall to the square, whose side is the line X.

First increase the sides through which the line of partition must passe, till they meet in H. then by the 47. prebleme, finde the base of a triangle equall to the Trapezia giuen, which will be A I. that done, reduce the square, whose side is the line X. into a tri-
angle, whose perpendicular may be equall to the per- 37.1
pendicular from B. vpon A D. so shall his base be the 12.6
distance IK. which set from I. to K. and then proceed 47.1
in all points as before, and finde the point P. then 31.6
drawe the line P E Q. so shall you cut off the figure P D C Q. equall to the square, whose side is the line X. which was required.

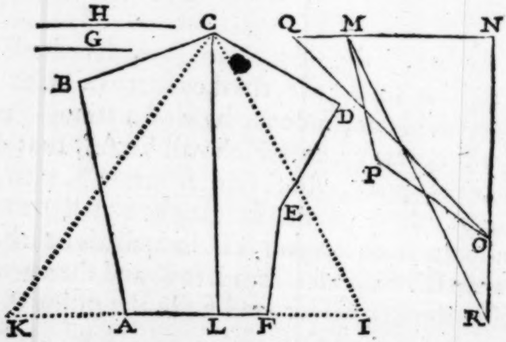
And in the same manner, may be cut off a number of Acres, with a line drawne through the point E. For make any figure to containe so many Acres as the square, whose side is the line X. containeth, then cut off C D P Q. equall thereunto as already taught, so shall you cut off, so many Acres with a line drawne through a giuen point within, as was required.

Prob. CXIX.

Prob. CXIX.

To deuide a plot giuen, according to any proportion assigned, with a line drawne from an angle appointed, and to lay the part required, toward a place assigned.

Let ABCDEF. be a plot giuen, to be deuided into two parts,(as G.to H)with a line drawne from the angle C. and to lay the lesser part next A.



First consider on what side the line drawn from C. must fall, which will be the side AF. which drawe forth both waies at length to I. and to K. then by the 47. probleme, or by the latter part of the 48. reduce the plot into a triangle, with two
37.1. lines drawne from the angle C. or only finde the
10.6. points I. and K. (which is better) so shall IK. be the base of a triangle equall to the whole plot, whose perpendicular is the shortest distance from C. vpon that

that base. That done, deuide I K. in L. as G. to H. so that as G. to H. so I L. to L K. (and because the lesser part is to be laid next F.) therfore hauing deuided the base I K. according to the lines GH. set the lesser part from I. to L. els must it haue ben set from K. towards I. Lastly, drawe the line C L. so shall you deuide the plot into two parts, with a line drawne from the angle C. in proportion, one to the other, as G. to H. which was required.

Prob. CXX.

To cut off from a plot, with a line drawne from an angle assigned, a part equall to a figure giuen, and to lay the part cut off towards a place appointed.

Let in the last Diagram M N O P. be a figure giuen, to be cut off from the plot A B C D E F. with a line drawne from the angle C. and to lay the part cut off next F.

HEre you must likewise consider, to what side the line of partition C L. must be drawne, for that is alwaies to be first increased that way, as the figure cut off is to be laid, and in this case, there is no need to finde the base of a triangle equall to the whole plot as before: But it may suffice by the 48. probleme to drawe the line C I. (on that side as the plot is, to be laid) or only to finde the point I. and not the point K. at all. That done, reduce your figure M N O P. giuen to be cut off, into such a triangle, whose perpendicular may be equall to the perpendicular from C. (in the plot) to the base A F. as first into the triangle 37. 1 1. 6.

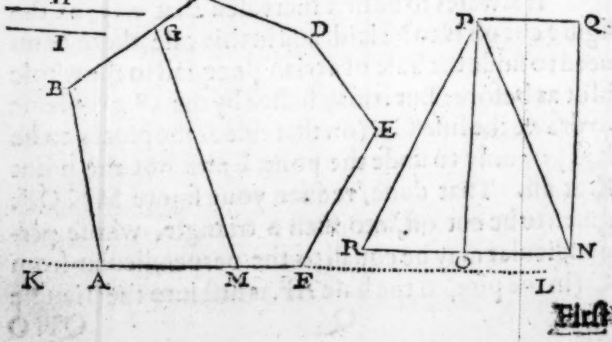
QNO. then that into the triangle MNR. whose perpendicular NR. may be equall to perpendicular from C. on IK. the base of the plot, so shall your figure MNOP. be at last brought into the triangle MNR. whose base is NM. which take and set in the plot from I. to L. (because it is required to lay the part cut off next F.) Lastly, drawe from C. to
37.1 L. the line CL. so shall you cut off the figure CDEFL
1.6 equall to MNOP. your figure giuen, with a line drawne from the angle C. as was required.

And in the same manner may you cut off a number of Acres Roods, Poles, &c. and lay them towards a place appointed.

PROB. CXXI.

To deuide a plot according to any proportion giuen, with a line drawne from a point assigned in any of his sides, and to lay the part required towards a place appointed.

Let ABCDEF. be a plot giuen, and let G. be a point assigned in the side BC. from whence a line is to be drawne to deuide the plot into two parts in proportion one to the other, as the line H. to the line I. and to lay the bigger part next F.



First

FIrſt, conſider to what ſide the line of partition GM. muſt be drawne, which will appeare to be the ſide AF. which increaſe both waies to K. and to L. That done, by the latter part of the 48. probleme, finde KL. for the baſe of a triangle, equall to the whole plot, whoſe perpendicular is the ſhorteſt diſtance from the point G. on that baſe, then deuide that baſe in M. as the line H. to the line I. (and becauſe 37.1
the bigger part is to be laid next F. therefore ſet the 10.6
bigger part of the baſe (being ſo deuided) from L. towards K. endeth in M. Laſtly, from the aſſigned point G. drawe to M. the line GM. ſo ſhall you deuide the plot into two parts in proportion one to the other, as the line H. to the line I. with a line drawne from the point G. and lay the bigger part next F. which was required.

Prob. CXXII.

To cut off from a plot giuen, with a line drawne from a point in one of his ſides, a part equall to a figure giuen, and to laye the part cut off towards a place appointed.

Let in the laſt Diagram ABCDEF. be a plot, and NOPQ. be a figure giuen, and it is required from the plot, to cut off ſo much as the figure NOPQ with a line drawne from the point G. and to lay the part cut off next A.

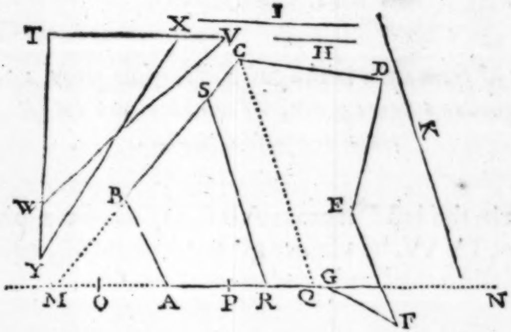
HEre is no need to finde the base of a triangle equall to the whole plot as before, but it may suffice to lengthen the side F A. and to finde the point K. by the 48. probleme, which is one end of the base of a triangle equall to the whole plot, whose perpendicnlar is the shortest distance from G. vpon that base, (and heere note, that the base F A. must be
37. 1. increased that way as the part cut off is to be laid, viz.
1. 6. towards A.) That done, reduce your figure giuen N O P Q. to be cut off into such a triangle, whose perpendicular may be equall to a perpendicular from the giuen point G. vpon the base(of the plot) AF. as into the triangle NPR. whose base is NR. which take and set from K. to M. Lastly, from the point G. to M. drawe the line G M. which shall cut off the part A B G M. next A. equall to the giuen figure N O P Q with a line drawne from the point G. as was required.

Prob. CXXIII.

To deuide a plot according to any proportion assigned, betweene two lines, with a parralell to a line giuen, and to lay the part required towards a place appointed.

Let A B C D E F G. be a plot giuen, to be deuided into two parts, in proportion one to the other, as the line H. to the line I. with a parralell to the line K. and to lay the lesser part next A.

First,



First consider through which sides the line of partition R S. shall passe, which will be the sides G A and C B. which increase till they meet in M. also, drawe forth the side or base A G. to N. then by the latter part of the 48. probleme, finde the whole base of a triangle equall to the plot, which will be ON. whose perpendicular shall be the shortest distance from C. to the base. Then deuide that base O N. in P. 37, 1
as H. to I. and set the lesser part from Q. to P. next A. 10. 6.
(because it is so required) Then by C. drawe a parra- 1. 6
lell to the giuen line K. to cut the base O N. in Q. as 13. 6
the pricked line C Q. That done, betweene M P. and M Q. finde a meane proportion, as M R. Lastly, by the point R. drawe a parralell to the line K. as R S. so shall you deuide the giuen plot into two parts, as H. to I. and also lay the lesser part next A. with a parralell to the line K. as was required.

Prob. CXXIIII.

To cut off from a plot with a parralell to a line giuen, a part equall to a figure giuen, and to lay the part cut off towards a place appointed.

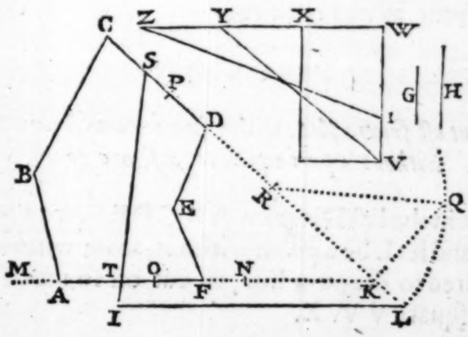
Let in the laſt Diagram A B C D F G. be a plot, and let T V W. be a figure giuen to be cut off, with a parralell to the line K. and to lay it next A.

FIrſt conſider through what ſides the line of partition muſt paſſe which are G A. and C B. which increaſe till they meet in M. then by the 48. probleme, finde the baſe of a triangle equall to the whole plot, as O N. whoſe perpendicular is the ſhorteſt diſtance from C. vpon that baſe, That done, reduce your figure giuen to be cut off, viz. T V W. into a triangle,
37. 1 gure giuen to be cut off, viz. T V W. into a triangle,
1. 6 whoſe perpendicular may be equall to a perpendicu-
Cor, 19. 6. lar from C. vpon the baſe O N. as into the triangle T X Y. whoſe baſe is T X. which take and ſet from O. to P. Then by C. drawe a parralell to the line K. as the pricked line C Q. to cut the baſe O N. in Q. That done, finde a meane proportion betweene M Q. and M P. as M R. Laſtly, by the point R. drawe a parralell to the giuen line K. as R S. ſo ſhall you cut off the part B A R S. equall to T V W. the figure giuen, and lay it next A. with a parralell to the line K. as was required.

Prob. CXXV.

To deuide a plot, according to any proportion assigned, with a line drawne from a point without.

Let A B C D E F. be a plot giuen, to be deuided into two parts in proportion one to the other, as the line G. to the line H. with a line drawne from the point I.



First consider, through which sides the line drawne from the point I. must passe, which will appeare to be A F. and CD. therfore, increase them till they meet in K. and drawe forth C D. at length to L. then by the point I. drawe a parralell to A K. as I L. to meet with C D. being drawne forth in L. That done, finde by the 48. probleme, the points M N. so is the line M N. the base of a triangle equall to the whole plot, whose perpendicular is the shortest distance from C. vpon that base, which base M N. deuide by the

24. probleme,

37.1. 24. probleme, in O. as G. to H, viz. that as G. to H.
10.6. so N O. to O M. then say by the 23. probleme, if L I.
13.6 giue K O. what K C? answer K P. that done, between
47.1 L K. and K P. finde a meane proportion, as K Q. then
16.6 deuide alwaies, K P. into two equall parts in R. and
drawe the line R Q. which set from R. to S. Lastly,
from the point I. to S. drawe the line I T S. so shall
you deuide the plot giuen, A B C D E F. into two
parts, viz. S D E[illegible]T. the lesser, and S C B A T. the
bigger, in proportion one to the other, as the line G.
to the line H. and with a line drawne from the point
I. without, as was required.

Prob. CXXVI.

To cut off from a plot, with a line drawne from a point without a part equall to a figure giuen,

Let in the last Diagram A B C D E F. be a plot giuen, and let I. be a point without, from whence it is required to drawe a line, to cut off so much as the long square V W X.

FIrst as before, consider through which sides the line of partition shall passe, which are A F. and C D. the which increase till they meet in K. then finde the point N. by the 48. probleme (for it needeth not to finde the point M. and so to get the whole base of a triangle equall to your plot) That done, reduce
37.1. your figure giuen to be cut off, viz. V X. into the tri-
13.6. angle V W Y. and againe, that triangle into the tri-
47.1. angle Z W I. whose perpendicular Z W. may be e-
16.6. quall to a perpendicular from C. vpon the base A F.

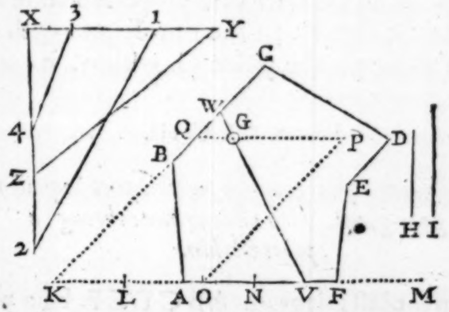
of

of your plot giuen, then is the base of that triangle W 1. which take and set from N. to O. then according to the last probleme, finde the point S. and draw the line I T S. which shall cut off the figure S D E F T. equall to V W X. the long square giuen, which was required.

PROB. CXXVII.

To deuide a plot into two parts, (according to any possible proportion giuen) with a line drawne through a point within.

Let A B C D E F. be a plot giuen, and let G. be a point within, & it is required to drawe a line through that point to deuide the plot into two parts in proportion, as the line H. to the line I.



First consider, through which sides the line of partition shall passe, which will easily appeare to be the sides C B. and F A. the which increase till they meet in K. then by the 48. probleme, finde L M. the base of a triangle equall to the whole plot, (whose perpendicular is the shortest distance from C. vpon that base,) which base L M. deuide by the 24. pro-

bleme, in N. as H. to I. so that as H to I. LN. may be to N M. That done, from the point G. within, let fall a perpendicular to the base L M. or take the shortest distance to it, and then say by the 23. probleme, if
37.1. that perpendicular or shortest distance, giue the per-
10.6 pendicular from C. vpon the base L M. what the ½ of
12. 6. K N? answer K O. which set from K. to O. then by O.
47. 1. drawe a parralell to K C. as O P. and by the point G
31. 6 drawe also a parralell to the base L M. as Q G P. to meet with the other parralell in P. That done, take by the 55. probleme, the square of Q G. from the square of G P. rest in the right angled triangle 3 X 4. the line X 4. for the side of a square remaining, which take, and set from O. to V. Lastly, drawe the line V G W. which shall deuide the plot into two parts viz. W B A V. and W C D E F V. in proportion one to the other, as the line H. to the line I. and with a line drawne through the point G. within, as was required.

Prob. CXXVIII.

To cut off from a plot giuen (a possible part) equall to a figure giuen, with a line drawne through a point within.

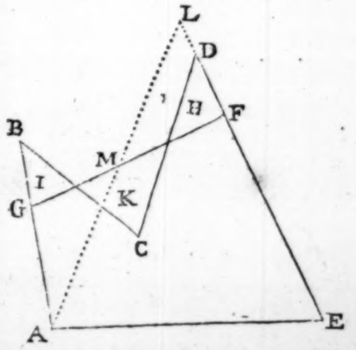
Let in the last Diagram A B C D E F. be a plot giuen, and let it be required to cut from it so much as the triangle Y X Z. with a line drawne through the point G. within.

First consider, through which sides the line drawn by G. must passe, which are C B. and F A. the which increase till they meete in K. then bring your

your triangle YXZ. to be cut off, into the triangle 1 X 2. whose perpendicular X 2. may be equall to a perpendicular from C.(in your plot)to the base L M. so shall X I. be the base of that triangle, which take, and set from L. to N. then say as before, if the perpendicular or shortest distance, from G. vpon L M. giue the perpendicular or shortest distance from C. vpon the same base L M. what the $\frac{1}{2}$ of K N? answer K O. then by O. drawe a parralell to K C. aud so finish it in all points, as in the last probleme, and drawe the line V G W. so shall you cut off the figure W B A V. equall to Y X Z. the triangle giuen, with a line drawn through the point G. within, as was reqnired.

Prob. CXXIX.

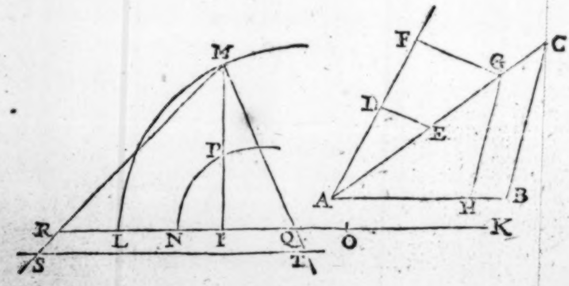
There is a plot as A B C D E. and in the side D E. is a point as F. from the which it is reqüired to drawe a line as F G. to cut off the two triangles H. and I. and to take in the triangle K. equall to them both, so that the Trapezia A G F E. may be equall to the giuen plot A B C D E. &c.



FIrst, bring the plot into the triangle A E L. equall thereunto, and then by the 39. probleme (counting EL. | L A. | and A B. | the three lines, and F. the point giuen) cut off the triangle F L M. and take in the triangle A G M. equall thereunto, by drawing the line
37. 1. F G. according as in the said 39. probleme, is taught, so shall you get the Trapezia A G F E. equall to the plot giuen, A B C D E. and then of necessitie must the triangle K. taken in, be equall to both the triangles H. and I. cut off together, which was required.

Prob. CXXX.

There is a peece of ground, as A B C. and adioyning to it another part as A D E. whose side A D. ruuneth forth by F. now it is required, to finde a point in the side A C. as G. from whence a parralell drawne to C B. as G H. and another to E D. as G F. in such sort, that the part G C B H. cut off, may be equall to the part F G E D. taken in, so that the whole Trapezia A F G H may be equall to the two triangles A B C. and A D E. together.



First

FIrst betweene A C. and his perpendicular from B. finde a meane proportion which will be I M. also betweene A E. and his perpendicular from D. finde another meane which will be I P. then by the 54. probleme, adde their squares together, so shall the line M Q. be the side of a square equall to them both, that done, by the 52. probleme, deuide the side A C. in power as A E. to his perpendicular from D. so that as the perpendicular from D. vpon his base A E. to A E. so the lesser part of the power of A C. to the power of A C. being so deuided, which lesser part in power is the line I R. whose square adde to the square of I M. so shall M R. be the side of a square equall to them both, that done, say by the 23. probleme, if M R giue M Q. what A C. which is M S? answer M T. which take and set from A. to G. vpon the side A C. Lastly, by G. drawe a parralell to C B. as G H. Also, a parralell to E D. as G F. so shall you cut off the Trapezia G C B H. and take in the Trapezia F G E D. equall thereunto, so that the whole Trapezia A F G H. shall be equall to both the triangles A B C. and A D E. together, which was required.

From whence a further knowledge may be deriued, that is, how to cut off from a triangle | Trapezia | or plot | any part or parts with a parralell to a crooked line, as with a parralell to F G H. &c. but of that and other things hereafter, if God spare life, in the meane time I request thee gentle Reader to peruse this well, so shalt thou be the readier to vnderstand the rest, and if thou profit any thing thereby, giue God the

praiſe, and lend me thy good word, ſo ſhall I thinke my paines herein well beſtowed, wiſhing thee, mee, and all, the perfection of knowledge, which is to know God in Ieſus Chriſt, and ſo I commit thee and vs all to his mercifull protection.

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FINIS.